Contents

Preface xxv

1 Introduction to the CAPI 1
   What is the CAPI? 1
   The CAPI model 2
   The history of the CAPI 3

2 Getting Started 5
   Using the CAPI package 5
   Creating a window 6
   Linking code into CAPI elements 8

3 General Properties of CAPI Panes 11
   Generic properties 11
   Base classes 16
   Specifying titles 17
   Callbacks 19
   Displaying and entering text 20
   Displaying rich text 27
Hierarchy of panes  27
Accessing pane geometry  28
Special kinds of windows  28
Button elements  31
Adding a toolbar to an interface  34
Tooltips  35
Screens  36

4 General Considerations  39
The correct thread for CAPI operations  39
Redisplay  40
Support for multiple monitors  41

5 Choices - panes with items  43
Items  44
Button panel classes  44
List panels  48
Trees  55
Graph panes  56
Option panes  60
Text input choice  61
Menu components  61
General properties of choices  62
Operations on collections (choices) and their items  66

6 Laying Out CAPI Panes  69
Organizing panes in columns and rows  72
Other types of layout  76
Combining different layouts  77
Specifying geometry hints  79
Constraining the size of layouts  85
Other pane layouts  87
Changing layouts and panes within a layout  95

7 Programming with CAPI Windows  97
Initialization  97
Resizing and positioning  98
8 Creating Menus  109

Creating a menu  110
Presenting menus  111
Grouping menu items together  111
Creating individual menu items  114
The CAPI menu hierarchy  115
Mnemonics in menus  117
Accelerators in menus  119
Alternative menu items  119
Disabling menu items  120
Menus with images  121
The Edit menu on Cocoa  122
Popup menus for panes  122
Displaying menus programmatically  123
The Application menu  124

9 Adding Toolbars  125

Creating a toolbar button  126
Creating a toolbar with several buttons  126
Specifying the image for a toolbar button  128
Specifying toolbar callbacks  129
Specifying tooltips for toolbar buttons  130
Modifying toolbars  131
Advanced toolbar features  133
Disabling toolbar items  134
Non-standard toolbars  134

10 Defining Interface Classes - top level windows  137

The define-interface macro  138
An example interface  139
Adapting the example  141
Connecting an interface to an application 147
Controlling the appearance of the top level window 150
Querying and modifying interface geometry 151

11 Dialogs: Prompting for Input 153
   Some simple dialogs 154
   Prompting for values 155
   Window-modal Cocoa dialogs 161
   Dialog Owners 162
   Creating your own dialogs 163
   In-place completion 168

12 Creating Panes with Your Own Drawing and Input 173
   Displaying graphics 173
   Receiving input from the user 177
   Creating graphical objects 187
   output-pane scrolling 199
   Transient display on output-pane and subclasses 202

13 Drawing - Graphics Ports 205
   Introduction 205
   Features 209
   Graphics state 211
   Drawing functions 212
   How to draw to an on-screen port 213
   Graphics state transforms 213
   Combining source and target pixels 215
   Pixmap graphics ports 216
   Portable font descriptions 217
   Working with images 219

14 Graphic Tools drawing objects 229
   Lower level - drawing objects and objects displayers 229
   Higher level - drawing graphs and bar charts 236

15 The Color System 241
   Introduction 241
Reading the color database 242
Color specs 243
Color models 244
Color aliases 246
Loading the color database 247
Defining new color models 247

16 Printing from the CAPI—the Hardcopy API 249
Printers 249
Print jobs 250
Handling pages—page on demand printing 250
Handling pages—page sequential printing 250
Printing a page 251
Other printing functions 252
Printing on Motif 252

17 Drag and Drop 255
Overview of drag and drop 255
Dragging 256
Dropping 259
Limitations of CAPI drag and drop 262

18 Miscellaneous functionality 263
Development functions 263
Sounds 264
Modifier keys state 264
Restoring display while debugging 264
Object properties and name 265
Clipboard 265
Handles 265

19 Host Window System-specific issues 267
Microsoft Windows-specific issues 267
Cocoa-specific issues 268
GTK+-specific issues 268
Motif-specific issues 270
CAPI communication with host window system - libraries 272
20  **Self-contained examples**  275

- Output pane examples  275
- Graphics examples  277
- Pinboard examples  278
- Examples using timers to implement "animation"  279
- Drag and Drop examples  279
- Graph examples  280
- Cocoa-specific examples  280
- Examples of complete CAPI applications  280
- Choice examples  281
- Examples of dialogs and prompts  282
- Editor-pane examples  282
- Menu examples  283
- Miscellaneous examples  283
- GTK+ specific examples  284
- Motif specific examples  284
- Layout examples  284
- Tooltip examples  285
- Examples illustrating other pane classes  285
- Printing examples  286
- Graphic Tools examples  286

21  **CAPI Reference Entries**  289

- abort-callback  289
- abort-dialog  290
- abort-exit-confirm  291
- accepts-focus-p  292
- activate-pane  293
- active-pane-copy  294
- active-pane-copy-p  294
- active-pane-cut  294
- active-pane-cut-p  294
- active-pane-deselect-all  294
- active-pane-deselect-all-p  294
- active-pane-paste  294
- active-pane-paste-p  294
- active-pane-select-all  294
- active-pane-select-all-p  294
active-pane-undo 294
active-pane-undo-p 294
append-items 295
apply-in-pane-process 296
apply-in-pane-process-if-alive 297
arrow-pinboard-object 298
attach-interface-for-callback 300
attach-simple-sink 301
attach-sink 302
beep-pane 303
browser-pane 304
browser-pane-available-p 312
browser-pane-busy 313
browser-pane-go-forward 313
browser-pane-go-back 313
browser-pane-navigate 313
browser-pane-refresh 313
browser-pane-stop 313
browser-pane-property-get 315
browser-pane-property-put 315
button 315
button-panel 321
calculate-constraints 326
calculate-layout 327
call-editor 328
callbacks 329
can-use-metafile-p 332
capi-object 333
capi-object-property 334
check-button 335
check-button-panel 336
choice 337
choice-selected-item 341
choice-selected-item-p 342
choice-selected-items 343
choice-update-item 345
clipboard 346
clipboard-empty 348
clone 348
cocoa-default-application-interface 349
cocoa-view-pane 353

cocoa-view-pane-view 355

collect-interfaces 355

collection 357

collection-find-next-string 360

collection-find-string 361

collection-last-search 362

collection-search 362

collector-pane 363

color-screen 364

column-layout 365

component-name 368

confirm-quit 368

confirm-yes-or-no 370

confirm-pane 370

contain 371

convert-relative-position 373

convert-to-screen 374

count-collection-items 377

create-dummy-graphics-port 378

current-dialog-handle 379

current-document 380

current-pointer-position 380

Current-popup 381

Current-printer 382

*default-editor-pane-line-wrap-marker* 383

*default-non-focus-message-timeout* 383

*default-non-focus-message-timeout-extension* 383

default-library 384

define-command 384

define-interface 387

define-layout 394

define-menu 395

define-ole-control-component 396

destroy 398

destroy-dependent-object 399

detach-simple-sink 400

detach-sink 401

display 402

display-dialog 404
display-errors 407
display-message 407
display-message-for-pane 408
display-non-focus-message 409
display-pane 412
display-pane-selected-text 413
display-pane-selection 414
display-pane-selection-p 414
display-popup-menu 415
display-replacable-dialog 416
display-tooltip 417
docking-layout 418
docking-layout-pane-docked-p 422
docking-layout-pane-visible-p 423
document-container 424
document-frame 424
double-headed-arrow-pinboard-object 425
double-list-panel 426
drag-pane-object 429
draw-metafile 431
draw-metafile-to-image 432
draw-pinboard-layout-objects 434
draw-pinboard-object 435
draw-pinboard-object-highlighted 436
drawn-pinboard-object 437
drop-object-allows-drop-effect-p 438
drop-object-collection-index 439
drop-object-collection-item 440
drop-object-drop-effect 441
drop-object-get-object 442
drop-object-pane-x 443
drop-object-pane-y 443
drop-object-provides-format 444
*echo-area-cursor-inactive-style* 445
echo-area-pane 445
*editor-cursor-active-style* 446
*editor-cursor-color* 446
*editor-cursor-drag-style* 447
*editor-cursor-inactive-style* 447
editor-pane 448
editor-pane-blink-rate 457
editor-pane-buffer 458
*editor-pane-composition-selected-range-face-plist* 459
editor-pane-default-composition-callback 459
*editor-pane-default-composition-face* 461
editor-pane-native-blink-rate 462
editor-pane-selected-text 462
editor-pane-selected-text-p 463
editor-pane-stream 463
editor-window 464
element 464
element-container 470
element-interface-for-callback 470
element-screen 471
ellipse 471
ensure-area-visible 472
ensure-interface-screen 472
execute-with-interface 473
execute-with-interface-if-alive 474
exit-confirm 476
exit-dialog 477
expandable-item-pinboard-object 478
extended-selection-tree-view 478
filtering-layout 479
filtering-layout-match-object-and-exclude-p 484
find-graph-edge 484
find-graph-node 485
find-interface 486
find-string-in-collection 487
force-screen-update 487
force-update-all-screens 488
foreign-owned-interface 488
form-layout 489
free-metafile 490
free-sound 491
get-collection-item 491
get-constraints 492
get-horizontal-scroll-parameters 493
get-page-area 494
get-printer-metrics 495
get-scroll-position 496
get-vertical-scroll-parameters 497
graph-edge 498
graph-node 499
graph-node-children 499
graph-object 500
graph-pane 500
graph-pane-add-graph-node 505
graph-pane-delete-object 506
graph-pane-delete-objects 506
graph-pane-delete-selected-objects 507
graph-pane-direction 507
graph-pane-edges 508
graph-pane-nodes 509
graph-pane-object-at-position 509
graph-pane-select-graph-nodes 510
graph-pane-update-moved-objects 511
grid-layout 511
hide-interface 516
hide-pane 517
highlight-pinboard-object 517
image-list 518
image-locator 520
image-pinboard-object 520
image-set 521
install-postscript-printer 522
installed-libraries 524
interactive-pane 525
interactive-pane-execute-command 527
interface 528
interface-customize-toolbar 548
interface-display 548
interface-display-title 550
interface-document-modified-p 550
interface-editor-pane 551
interface-extend-title 552
interface-geometry 553
interface-iconified-p 553
interface-keys-style 554
interface-match-p 556
interface-menu-groups 557
interface-preserve-state 558
interface-preserving-state-p 559
interface-reuse-p 560
interface-toolbar-state 561
interface-visible-p 563
interpret-description 564
invalidate-pane-constraints 565
invoke-command 566
invoke-untranslated-command 566
item 567
item-pane-interface-copy-object 569
item-pinboard-object 570
itemp 571
labelled-arrow-pinboard-object 571
labelled-line-pinboard-object 572
layout 573
line-pinboard-object 575
line-pinboard-object-coordinates 576
list-panel 577
list-panel-enabled 589
list-panel-filter-state 589
list-panel-items-and-filter 590
list-panel-search-with-function 591
list-panel-unfiltered-items 593
list-view 594
listener-pane 600
listener-pane-insert-value 600
load-cursor 601
load-sound 605
locate-interface 606
lower-interface 607
make-container 608
make-docking-layout-controller 609
make-foreign-owned-interface 609
make-general-image-set 611
make-icon-resource-image-set 612
make-image-locator 613
make-menu-for-pane 613
make-pane-popup-menu 615
make-resource-image-set 617
make-scaled-general-image-set 618
make-scaled-image-set 619
make-sorting-description 620
manipulate-pinboard 622
map-collection-items 625
map-pane-children 626
map-pane-descendant-children 629
map-typeout 630
*maximum-moving-objects-to-track-edges* 630
menu 631
menu-component 636
menu-item 638
menu-object 644
merge-menu-bars 648
message-pane 650
metafile-port 650
modify-editor-pane-buffer 651
modify-multi-column-list-panel-columns 651
mono-screen 653
move-line 653
multi-column-list-panel 654
multi-line-text-input-pane 659
non-focus-list-add-filter 660
non-focus-list-remove-filter 660
non-focus-list-toggle-filter 660
non-focus-list-interface 661
non-focus-list-toggle-enable-filter 661
non-focus-maybe-capture-gesture 662
non-focus-terminate 663
non-focus-update 664
ole-control-add-verbs 665
ole-control-close-object 665
ole-control-component 666
ole-control-doc 668
ole-control-frame 669
ole-control-i-dispatch 670
ole-control-insert-object 670
ole-control-ole-object 671
ole-control-pane 672
ole-control-pane-frame 674
ole-control-pane-simple-sink 675
ole-control-user-component 676
option-pane 677
output-pane 682
output-pane-cache-display 694
output-pane-cached-display-user-info 695
output-pane-draw-from-cached-display 696
output-pane-free-cached-display 697
output-pane-resize 698
output-pane-stop-composition 699
over-pinboard-object-p 700
page-setup-dialog 701
pane-adjusted-offset 702
pane-adjusted-position 703
pane-can-restore-display-p 705
pane-close-display 705
pane-descendant-child-with-focus 706
pane-got-focus 707
pane-has-focus-p 707
pane-initial-focus 708
pane-interface-copy-object 709
pane-interface-copy-p 709
pane-interface-cut-object 709
pane-interface-cut-p 709
pane-interface-deselect-all 709
pane-interface-deselect-all-p 709
pane-interface-paste-object 709
pane-interface-paste-p 709
pane-interface-select-all 709
pane-interface-select-all-p 709
pane-interface-undo 709
pane-interface-undo-p 709
pane-modifiers-state 710
pane-popup-menu-items 712
pane_restore-display 715
pane-screen-internal-geometry 715
pane-string 717
pane-supports-menus-with-images 718
parse-layout-descriptor 718
password-pane 720
pinboard-layout 721
pinboard-layout-display 725
pinboard-object 726
pinboard-object-at-position 732
pinboard-object-graphics-arg 733
pinboard-object-highlighted-p 734
pinboard-object-overlap-p 735
pinboard-pane-position 735
pinboard-pane-size 737
play-sound 738
popup-confirmers 738
popup-menu-button 749
popup-menu-force-popdown 749
*ppd-directory* 750
print-capi-button 751
print-collection-item 752
print-dialog 753
print-editor-buffer 755
print-file 755
print-rich-text-pane 756
print-text 757
printer-configuration-dialog 758
printer-metrics 759
printer-port 760
printer-port-handle 761
printer-port-supports-p 762
*printer-search-path* 762
process-pending-messages 763
progress-bar 764
prompt-for-color 765
prompt-for-confirmation 766
prompt-for-directory 767
prompt-for-file 769
prompt-for-files 773
prompt-for-font 774
prompt-for-form 775
prompt-for-forms 776
prompt-for-integer 778
prompt-for-items-from-list 779
screen-active-interface 832
screen-active-p 832
screen-internal-geometries 833
screen-internal-geometry 834
screen-logical-resolution 836
screen-monitor-geometries 836
screens 837
scroll 838
scroll-bar 840
scroll-if-not-visible-p 842
search-for-item 843
selection 844
selection-empty 845
set-application-interface 846
set-button-panel-enabled-items 847
set-clipboard 848
set-composition-placement 849
set-confirm-quit-flag 850
set-default-editor-pane-blink-rate 851
set-default-interface-prefix-suffix 852
set-default-use-native-input-method 854
set-display-pane-selection 854
set-drop-object-supported-formats 855
set-editor-parenthesis-colors 857
set-geometric-hint 858
set-highlight-table 858
set-horizontal-scroll-parameters 859
set-interactive-break-gestures 860
set-list-panel-keyboard-search-reset-time 861
set-object-automatic-resize 862
set-pane-focus 867
set-printer-metrics 867
set-printer-options 868
set-rich-text-pane-character-format 870
set-rich-text-pane-paragraph-format 873
set-selection 875
set-text-input-pane-selection 876
set-top-level-interface-geometry 876
set-vertical-scroll-parameters 878
shell-pane 879
show-interface 881
show-pane 881
simple-layout 882
simple-network-pane 882
simple-pane 883
simple-pane-handle 895
simple-pane-visible-height 895
simple-pane-visible-size 896
simple-pane-visible-width 897
simple-pinboard-layout 897
simple-print-port 898
slider 900
sort-object-items-by 903
sorted-object 903
sorted-object-sort-by 904
sorted-object-sorted-by 905
start-drawing-with-cached-display 906
start-gc-monitor 909
static-layout 909
static-layout-child-geometry 911
static-layout-child-position 912
static-layout-child-size 913
stop-gc-monitor 914
stop-sound 915
switchable-layout 915
switchable-layout-switchable-children 917
tab-layout 918
tab-layout-panes 922
tab-layout-visible-child 923
text-input-choice 923
text-input-pane 925
text-input-pane-append-recent-items 941
text-input-pane-delete-recent-items 941
text-input-pane-prepend-recent-items 941
text-input-pane-replace-recent-items 941
text-input-pane-complete-text 942
text-input-pane-copy 943
text-input-pane-cut 944
text-input-pane-delete 944
text-input-pane-in-place-complete 945
text-input-pane-paste 945
text-input-pane-recent-items 946
text-input-pane-selected-text 947
text-input-pane-selection 947
text-input-pane-selection-p 948
text-input-pane-set-recent-items 949
text-input-range 950
title-pane 952
titled-menu-object 954
titled-object 954
titled-pinboard-object 958
toolbar 960
toolbar-button 963
toolbar-component 968
toolbar-object 971
top-level-interface 972
top-level-interface-display-state 972
top-level-interface-geometry 974
top-level-interface-geometry-key 975
top-level-interface-p 977
top-level-interface-save-geometry-p 977
tracking-pinboard-layout 978
tree-view 978
tree-view-ensure-visible 990
tree-view-expanded-p 990
tree-view-item-checkbox-status 991
tree-view-item-children-checkbox-status 992
tree-view-update-an-item 993
tree-view-update-item 993
undefine-menu 994
unhighlight-pinboard-object 994
uninstall-postscript-printer 995
unmap-typeout 996
update-all-interface-titles 996
update-drawing-with-cached-display 997
update-drawing-with-cached-display-from-points 997
update-interface-title 999
update-pinboard-object 1000
update-screen-interface-titles 1000
*update-screen-interfaces-hooks* 1001
update-toolbar 1001
virtual-screen-geometry 1002
with-atomic-redisplay 1002
with-busy-interface 1003
with-dialog-results 1004
with-document-pages 1007
with-external-metafile 1008
with-geometry 1011
with-internal-metafile 1014
with-output-to-printer 1016
with-page 1017
with-page-transform 1018
with-print-job 1019
with-random-typeout 1021
wrap-text 1021
wrap-text-for-pane 1022
x-y-adjustable-layout 1023

22 GRAPHICS-PORTS Reference Entries 1025

2pi 1025
analyze-external-image 1026
apply-rotation 1026
apply-rotation-around-point 1027
apply-scale 1028
apply-translation 1029
augment-font-description 1030
clear-external-image-conversions 1031
clear-graphics-port 1031
clear-graphics-port-state 1032
clear-rectangle 1032
compress-external-image 1033
compute-char-extents 1034
convert-external-image 1035
convert-to-font-description 1035
copy-area 1036
copy-external-image 1038
copy-pixels 1038
copy-transform 1040
create-pixmap-port 1040
*default-image-translation-table* 1042
define-font-alias 1042
destroy-pixmap-port 1043
dither-color-spec 1043
draw-arc 1044
draw-arcs 1045
draw-character 1046
draw-circle 1047
draw-ellipse 1048
draw-image 1049
draw-line 1052
draw-lines 1053
draw-path 1053
draw-point 1057
draw-points 1058
draw-polygon 1059
draw-polygons 1060
draw-rectangle 1061
draw-rectangles 1062
draw-string 1063
ensure-gdiplus 1064
external-image 1066
external-image-color-table 1067
external-image-color-table 1067
externalize-and-write-image 1068
externalize-image 1070
f2pi 1071
find-best-font 1072
find-matching-fonts 1073
font 1074
font-description 1075
font-description 1076
font-description-attribute-value 1076
font-description-attributes 1077
font-dual-width-p 1077
font-fixed-width-p 1078
font-single-width-p 1079
fpi 1079
fpi-by-2 1079
free-image 1080
free-image-access 1080
get-bounds 1081
get-char-ascent 1082
get-char-descent 1083
get-char-width 1083
get-character-extent 1084
get-enclosing-rectangle 1084
get-font-ascent 1085
get-font-average-width 1085
get-font-descent 1086
get-font-height 1086
get-font-width 1087
get-graphics-state 1087
get-origin 1088
get-string-extent 1089
get-transform-scale 1090
graphics-port-background 1090
graphics-port-font 1090
graphics-port-foreground 1090
graphics-port-transform 1090
graphics-port-mixin 1091
graphics-state 1092
image 1101
image-access-height 1101
image-access-width 1101
image-access-pixel 1102
image-access-pixels-from-bgra 1104
image-access-pixels-to-bgra 1105
image-access-transfer-from-image 1106
image-access-transfer-to-image 1107
image-freed-p 1108
image-loader 1108
image-translation 1109
initialize-dithers 1110
inset-rectangle 1110
inside-rectangle 1111
invalidate-rectangle 1112
invalidate-rectangle-from-points 1113
invert-transform 1114
list-all-font-names 1115
list-known-image-formats 1115
load-icon-image 1116
load-image 1118
make-dither 1120
make-font-description 1121
make-graphics-state 1122
make-image 1123
make-image-access 1123
make-image-from-port 1125
make-sub-image 1125
make-transform 1126
merge-font-descriptions 1127
offset-rectangle 1128
ordered-rectangle-union 1128
pi-by-2 1129
pixblt 1130
 pixmap-port 1131
port-drawing-mode-quality-p 1131
port-graphics-state 1132
port-height 1133
port-owner 1133
port-string-height 1134
port-string-width 1134
port-width 1135
postmultiply-transforms 1135
premultiply-transforms 1136
read-and-convert-external-image 1136
read-external-image 1137
 rect-bind 1139
rectangle-bind 1139
rectangle-bottom 1140
rectangle-height 1141
rectangle-left 1141
rectangle-right 1142
rectangle-top 1142
rectangle-union 1143
rectangle-width 1144
register-image-load-function 1144
register-image-translation 1145
reset-image-translation-table 1146
separation 1146
set-default-image-load-function 1147
set-graphics-port-coordinates 1148
set-graphics-state 1149
transform 1149
transform-area 1150
transform-distance 1151
transform-distances 1151
transform-is-rotated 1152
transform-point 1152
transform-points 1153
transform-rect 1154
undefine-font-alias 1154
union-rectangle 1155
*unit-transform* 1155
unit-transform-p 1156
unless-empty-rect-bind 1156
untransform-distance 1157
untransform-distances 1158
untransform-point 1159
untransform-points 1159
validate-rectangle 1160
with-dither 1161
with-graphics-mask 1162
with-graphics-post-translation 1163
with-graphics-rotation 1164
with-graphics-scale 1164
with-graphics-translation 1164
with-graphics-state 1166
with-graphics-transform 1167
with-graphics-transform-reset 1168
with-inverse-graphics 1169
with-pixmap-graphics-port 1170
with-transformed-area 1171
with-transformed-point 1172
with-transformed-points 1173
with-transformed-rect 1174
without-relative-drawing 1175
write-external-image 1175
23 LW-GT Reference Entries 1177

apply-drawing-object 1178
basic-graph-spec 1179
compound-drawing-object 1180
compute-drawing-object-from-data 1181
recurse-compute-drawing-object 1181
drawing-object 1183
fit-object 1185
make-absolute-drawing 1185
make-absolute-drawing* 1185
position-object 1185
position-and-fit-object 1185
rotate-object 1185
force-objects-redraw 1189
generate-bar-chart 1190
generate-graph-from-pairs 1193
generate-grid-lines 1194
generate-labels 1199
geometry-drawing-object 1201
make-a-drawing-call 1202
make-draw-arc 1202
make-draw-circle 1202
make-draw-ellipse 1202
make-draw-line 1202
make-draw-lines 1202
make-draw-polygon 1202
make-draw-rectangle 1202
make-basic-graph-spec 1205
basic-graph-spec-p 1205
copy-basic-graph-spec 1205
generate-graph-from-graph-spec 1205
make-draw-string 1207
make-pinboard-objects-displayer 1209
objects-displayer 1210
pinboard-objects-displayer 1213
string-drawing-object 1214

24 COLOR Reference Entries 1215

apropos-color-alias-names 1215
apropos-color-names 1216
apropos-color-spec-names 1217
color-alpha 1218
color-blue 1219
color-green 1219
color-red 1219
color-hue 1219
color-saturation 1219
color-value 1219
*color-database* 1220
color-from-premultiplied 1220
color-to-premultiplied 1221
color-level 1222
color-model 1223
color-with-alpha 1224
colors= 1225
convert-color 1225
define-color-alias 1226
define-color-models 1228
delete-color-translation 1229
ensure-color 1229
ensure-model-color 1230
ensure-rgb 1231
ensure-hsv 1231
ensure-gray 1231
get-all-color-names 1232
get-color-alias-translation 1233
get-color-spec 1234
load-color-database 1235
make-gray 1236
make-hsv 1237
make-rgb 1238
read-color-db 1239
unconvert-color 1240

Index 1241
This preface contains information you need when using the rest of the CAPI documentation. It discusses the purpose of this manual, the typographical conventions used, and gives a brief description of the rest of the contents.

About this manual

This manual contains a user guide section (previously published separately as the CAPI User Guide) and a reference section (previously the LispWorks CAPI Reference Manual).

Assumptions

The CAPI documentation assumes that you are familiar with:

- LispWorks.
- Common Lisp and CLOS, the Common Lisp Object System.
- Mac OS X.

Illustrations in this manual show the CAPI running on Mac OS X 10.5, so if you use a different version you should expect some variation from the figures depicted here.

Unless otherwise stated, examples given in this document assume that the current package has CAPI on its package-use-list.
Conventions used in the manual

Throughout this manual, certain typographical conventions have been adopted to aid readability.

1. Whenever an instruction is given, it is numbered and printed like this.

Text which you should enter explicitly is printed like this.

Exported symbols and example code are printed like-this. The package qualifier is often omitted, as if the current package is capi (or graphics-ports or color.)

Variable arguments, slots and return values are italicised. They look like-this in the main text.

User Guide section

The user guide section of this manual forms an introductory course in developing applications using the CAPI. Please note that, like the rest of the LispWorks documentation, it does assume knowledge of Common Lisp.

Chapter 1, Introduction to the CAPI, introduces the principles behind the CAPI, some of its fundamental concepts, and what it sets out to achieve.

Chapter 2, Getting Started, presents a series of simple examples to familiarize you with some of the most important elements and functions.

Chapter 3, General Properties of CAPI Panes, introduces more of the fundamental CAPI elements and common themes. These elements are explained in greater detail in the remainder of the manual.

Chapter 4, General Considerations, covers some general issues that you should be aware of when using CAPI, including information about multiple displays.

Chapter 5, Choices - panes with items, explains the key CAPI concept of the choice. A choice groups CLOS objects together and provides the notion of there being a selected object amongst that group of objects. Button panels and list panels are examples of choices.

Chapter 6, Laying Out CAPI Panes introduces the idea of layouts. These let you combine different CAPI elements inside a single window.
Chapter 7, *Programming with CAPI Windows*, outlines basic techniques for modifying existing windows.

Chapter 8, *Creating Menus*, shows you how to implement menus.

Chapter 9, *Adding Toolbars*, shows you how to add toolbars to a window.

Chapter 10, *Defining Interface Classes - top level windows*, introduces the macro `define-interface`. This macro can be used to define interface classes composed of CAPI elements, including the predefined elements described in this manual and also elements which you define.

Chapter 11, *Dialogs: Prompting for Input*, discusses the ways in which dialogs may be used to prompt the user for input.

Chapter 12, *Creating Panes with Your Own Drawing and Input*, shows you how you can define your own classes when the elements provided by the CAPI are not sufficient for your needs.

Chapter 13, *Drawing - Graphics Ports*, describes the Graphics Ports API which provides a selection of drawing and image transformation functions. Although not part of the CAPI package, and therefore not strictly part of the CAPI, the Graphics Ports functions are used in conjunction with CAPI panes, and are therefore documented in this manual. See also Chapter 22, *GRAPHICS-PORTS Reference Entries*.

Chapter 14, *Graphic Tools drawing objects*, describes the Graphic Tools API which provides a way to create more complex drawings, including graphs and bar charts. Graphic Tools are built with Graphics Ports and CAPI pinboards, and are therefore documented in this manual. See also Chapter 23, *LW-GT Reference Entries*.

Chapter 15, *The Color System*, allows applications to use keyword symbols as aliases for colors in Graphics Ports drawing functions. They can also be used for backgrounds and foregrounds of windows and CAPI objects. See also Chapter 24, *COLOR Reference Entries*.

Chapter 16, *Printing from the CAPI—the Hardcopy API*, describes the programmatic printing of Graphics Ports.

Chapter 17, *Drag and Drop*, describes how you can implement drag and drop in your CAPI application.
Chapter 19, *Host Window System-specific issues*, describes how to configure the appearance of CAPI windows on the various supported host window systems.

Chapter 20, *Self-contained examples*, enumerates the CAPI example files available in the LispWorks library.

**Reference section**

The reference section contains reference entries for the symbols in the `capi`, `graphics-ports`, `lw-gt` and `color` packages.

Within each chapter, the symbols are organized alphabetically (ignoring non-alphanumeric characters that are common in Lisp symbols, such as "). The typographical conventions used are similar to those used in *Common Lisp: the Language* (2nd Edition). Further details on the conventions used are given below. The chapters are:

Chapter 21, *CAPI Reference Entries*, describes the external symbols of the `capi` package.

Chapter 22, *GRAPHICS-PORTS Reference Entries*, describes the external symbols of the `graphics-ports` package.


Chapter 24, *COLOR Reference Entries*, describes the external symbols of the `color` package.

**Note:** Although the `graphics-ports` and `color` packages are not strictly part of the CAPI, they are included in this manual because the functionality is usually called from CAPI elements such as output panes. `lw-gt` is also included here since it is built on top of `graphics-ports` and `capi`. Chapter 13, “Drawing - Graphics Ports” and Chapter 15, “The Color System” shows you how to use the `graphics-ports` and `color` packages respectively; the remainder of the User Guide section shows you how to use the `capi` package.
Conventions used for reference entries

Each entry is headed by the symbol name and type, followed by a number of fields providing further details. These fields consist of a subset of the following: “Summary”, “Package”, “Signature”, “Method signatures”, “Arguments”, “Values”, “Initial value”, “Superclasses”, “Subclasses”, “Initargs”, “Accessors”, “Readers”, “Description”, “Notes”, “Compatibility notes”, “Examples” and “See also”.

Some symbols with closely-related functionality are coalesced into a single reference entry.

Entries with a long “Description” section usually have as their first field a short “Summary” providing a quick overview of the symbol’s purpose.

The “Package” section shows the package from which the symbol is exported.

The “Signature” section shows the arguments and return values of functions and macros, and the parameters of types.

In a Generic Function entry there may be a “Method signatures” section showing system-defined method signatures.

The “Arguments” and "Values" sections show types of the arguments and return values.

In a Variable entry, the “Initial value” section shows the initial value.

In a Class entry the “Subclasses” section of lists the external subclasses, though not subclasses of those, and the “Superclasses” section lists the external superclasses, though not superclasses of those. The “Initargs” section describes the initialization arguments of the class, though note that initargs of superclasses are also valid. There may be an “Accessors” section listing accessor functions which are both readers and writers, and/or a “Readers” section listing accessor functions which are only readers. Accessor functions access the slot with matching name.

The “Description” section contains the detail of what the symbol does, how each argument is interpreted (and its default value if applicable), and how each return value is derived. More incidental information may be shown in a “Notes” section.
A few entries have a “Compatibility notes” section describing changes in the symbol’s functionality relative to other LispWorks versions.

Examples are given under the “Examples” heading. Short examples are shown directly. Longer examples are supplied as source files in your LispWorks installation directory under examples/capi/. The convenience function lw:example-edit-file allows you to open these files in the LispWorks editor.

Note that the example code is written with explicit package qualifiers such as capi:interface, so that it can be run as-is, regardless of the current package.

Finally, the “See also” section provides links to other related symbols and user guide sections.

**Viewing example files**

This manual often refers to example files in the LispWorks library via a Lisp form like this:

```
(example-edit-file "capi/choice/drag-and-drop")
```

These examples are Lisp source files in your LispWorks installation under lib/7-0-0-0/examples/. You can simply evaluate the given form to view the example source file.

**The LispWorks manuals**

The LispWorks manual set also includes the following books:

- The *LispWorks IDE User Guide* describes the LispWorks IDE, the user interface for LispWorks. This is a set of windowing tools that help you to develop and test Common Lisp programs.
- The *LispWorks Editor User Guide* describes the keyboard commands and programming interface to the LispWorks IDE editor tool.
• The *LispWorks Foreign Language Interface User Guide and Reference Manual* explains how you can use C source code in applications developed using LispWorks.

• The *LispWorks Delivery User Guide* describes how you can deliver working, standalone versions of your LispWorks applications for distribution to your customers.

• *Developing Component Software with CORBA* describes how LispWorks can interoperate with other CORBA-compliant systems.


• The *KnowledgeWorks and Prolog User Guide* describes the LispWorks toolkit for building knowledge-based systems. Prolog is a logic programming system within Common Lisp.

• The *Common Lisp Interface Manager 2.0 User’s Guide* describes the portable Lisp-based GUI toolkit.

• The *LispWorks Release Notes and Installation Guide* which contains notes explaining how to install LispWorks and get it running. It also contains a set of release notes which lists new features and any last minute issues that could not be included in the main manual set.

These books are provided in both HTML and PDF formats, and may also be found at [www.lispworks.com/documentation](http://www.lispworks.com/documentation).

Commands in the **Help** menu of any of the LispWorks IDE tools give you direct access to your local copy of the HTML format manuals. Details of how to use these commands can be found in the *LispWorks IDE User Guide*.

Please let us know at lisp-support@lispworks.com if you find any mistakes in the LispWorks documentation, or if you have any suggestions for improvements.
Introduction to the CAPI

1.1 What is the CAPI?

The CAPI (Common Application Programmer’s Interface) is a library for implementing portable window-based application interfaces. It is a conceptually simple, CLOS-based model of interface elements and their interaction. It provides a standard set of these elements and their behaviors, as well as giving you the opportunity to define elements of your own.

The CAPI’s model of window-based user interfaces is an abstraction of the concepts that are shared between all contemporary window systems, such that you do not need to consider the details of a particular system. These hidden details are taken care of by a back end library written for that system alone.

An advantage of making this abstraction is that each of the system-specific libraries can be highly specialized, concentrating on getting things right for that particular window system. Furthermore, because the implementation libraries and the CAPI model are completely separate, libraries can be written for new window systems without affecting either the CAPI model or the applications you have written with it.

The CAPI currently runs under X Window System with either GTK+ or Motif, Microsoft Windows and Mac OS X. Using CAPI with Motif is deprecated.
1 Introduction to the CAPI

1.2 The CAPI model

The CAPI provides an abstract hierarchy of classes which represent different sorts of window interface elements, along with functions for interacting with them. Instances of these classes represent window objects in an application, with their slots representing different aspects of the object, such as the text on a button, or the items on a menu. These instances are not actual window objects but provide a convenient representation of them for you. When you ask the CAPI to display your object, it creates a real window system object to represent it. This means that if you display a CAPI button, a real Windows button is created for it when running on Microsoft Windows, a real GTK+ button when running on GTK+, and a real Cocoa button when running on Cocoa.

The CAPI's approach makes the production of the screen objects the responsibility of the native window system, so it always produces the correct look and feel. Furthermore, the CAPI's use of the real interface to the window system means that it does not need to be upgraded to account for look and feel changes, and anything written with it is upwardly compatible, just like any well-written application.

1.2.1 CAPI elements

There are five types of elements in the CAPI model: interface, menu, pane, layout and pinboard-object.

Everything that the CAPI displays is contained within an interface (an instance of the class interface). When an interface is displayed a window appears containing all the menus and panes you have specified for it. Top level windows in an application are normally defined as an interface subclass, by using define-interface.

An interface can contain a number of menus collected together on a menu bar, and context menus can also appear elsewhere. Each menu can contain menu items or other menus (that is, submenus). Items can be grouped together visually and functionally inside menu components. Menus, menu items, and menu components are, respectively, instances of the classes menu, menu-item, and menu-component.

Panels are window objects such as buttons and lists. They can be positioned anywhere in an interface. The CAPI provides many different kinds of pane.
class, among them push-button, list-panel, text-input-pane, editor-pane, tree-view and graph-pane.

The positions of panes are controlled by a layout, which allows objects to be collected together and positioned either regularly (with instances of the classes column-layout, row-layout or grid-layout) or arbitrarily using a pinboard-layout. Layouts themselves can be laid out by other layouts — for example, a row of buttons can be laid out above a list by placing both the row-layout and the list in a column-layout.

pinboard-objects are lightweight elements that you can use to create complex display and user interaction. They must be used inside a pinboard-layout.

Note that layouts and interfaces are actually panes too (interface and layout are subclasses of simple-pane), and in most of the cases can be used where panes are used. They are listed separately because of their special role in the layout of windows.

1.3 The history of the CAPI

Window-based applications written with LispWorks 3 and previous used CLX², CLUE, and the LispWorks Toolkit. Such applications are restricted to running under X Windows. Because we and our customers wanted a way to write portable window code, we developed a new system for this purpose: the CAPI.

Part of this portability exercise was undertaken before the development of the CAPI, for graphics ports, the generic graphics library. This includes the portable color, font, and image systems in LispWorks. The CAPI is built on top of this technology, and has been implemented for Motif, Microsoft Windows, Cocoa and GTK+.

All Lisp-based environment and application development in LispWorks Ltd now uses the CAPI. We recommend that you use the CAPI for window-based application development in preference to the systems mentioned earlier.
1 Introduction to the CAPI
2

Getting Started

This chapter introduces some of the most basic CAPI elements and functions. The intention is simply that you should become familiar with the most useful elements available, before learning how you can use them constructively.

You should work through the examples in this chapter. For extended example code, see:

(example-edit-file "capi/elements/"

A CAPI application consists of a hierarchy of CAPI objects. CAPI objects are created using make-instance, and although they are standard CLOS objects, CAPI slots should generally be accessed using the documented accessors, and not using the CLOS slot-value function. You should not rely on slot-value because the implementation of the CAPI classes may evolve.

Once an instance of a CAPI object has been created in an interface, it can be displayed on your screen using the function display.

2.1 Using the CAPI package

All symbols in this manual are exported from either the CAPI or COMMON-LISP packages unless explicitly stated otherwise. To access CAPI symbols, you
could qualify them all explicitly in your code, for example `capi:output-pane`.

However it is more convenient to create a package which has CAPI on its package-use-list:

```lisp
(defunpackage "MY-PACKAGE"
  (:add-use-defaults t)
  (:use "CAPI")
)
```

This creates a package in which all the CAPI symbols are accessible. To run the examples in this guide, first evaluate

```lisp
(in-package "MY-PACKAGE")
```

### 2.2 Creating a window

This section shows how easy it is to create a simple window, and how to include CAPI elements, such as panes, in your window.

1. Enter the following in a listener

```lisp
(setq interface
  (make-instance 'interface
  :visible-min-width 200
  :title "My Interface"))

(display interface)
```

![Figure 2.1 Creating a simple window](image)

A small window appears on your screen, called "My Interface". This is the most simple type of window that can be created with the CAPI.

**Note:** By default this window has a menu bar with the **Works** menu. The **Works** menu gives you access to a variety of LispWorks tools, just like the **Works** menu of any window in the LispWorks IDE. It is automatically pro-
vided by default for any interface you create. You can omit it by passing
:auto-menus nil.

The usual way to display an instance of a CAPI window is display. However,
another function, contain, is provided to help you during the course of
development.

Notice that the "My Interface" window cannot be made smaller than the mini-
mum width specified. All CAPI geometry values (window size and position)
are integers and represent pixel values relative to the topmost/leftmost visible
pixel of the primary monitor.

Only a top level CAPI element is shown by display — that is, an instance of
an interface. To display other CAPI elements (for example, buttons, editor
panes, and so on), you must provide information about how they are to be
arranged in the window. Such an arrangement is called a layout — you will
learn more about layouts in Chapter 6.

On the other hand, contain automatically provides a default layout for any
CAPI element you specify, and subsequently displays it. During development,
it can be useful for displaying individual elements of interest on your screen,
without having to create an interface for them explicitly. However, contain is
only provided as a development tool, and should not be used for the final
implementation of a CAPI element. See Chapter 10, “Defining Interface
Classes - top level windows” on how to display CAPI elements in an interface.

Note that a displayed CAPI element should only be accessed in its own
thread. See “The correct thread for CAPI operations” on page 39 for more
information about this.

This is how you can create and display a button using contain.

1. Enter the following into a listener:
(setq button
        (make-instance 'push-button
            :data "Button"))

(contain button)

Figure 2.2 Creating a push-button interface

This creates an interface which contains a single push-button, with a label specified by the :data keyword. Notice that you could have performed the same example using display, but you would also have had to create a layout so that the button could have been placed in an interface and displayed.

You can click on the button, and it will respond in the way you would expect (it will depress). However, no code will be run which performs an action associated with the button. How to link code to window items is the topic of the next section.

### 2.3 Linking code into CAPI elements

Getting a CAPI element to perform an action is done by specifying a callback. This is a function which is performed whenever you change the state of a CAPI element. It calls a piece of code whenever a choice is made in a window.

Note that the result of the callback function is ignored, and that its usefulness is in its side-effects.

1. Try the following:
2.3 Linking code into CAPI elements

\[
\begin{verbatim}
(setq push-button
  (make-instance 'push-button
    :data "Hello"
    :callback
    #'(lambda (&rest args)
        (display-message
         "Hello World"))))
(contain push-button)
\end{verbatim}
\]

Figure 2.3 Specifying a callback

2. Click on the Hello button.
A dialog appears containing the message “Hello World”.

Figure 2.4 A dialog displayed by a callback.

The CAPI provides the function \texttt{display-message} to allow you to pop up a dialog sheet containing a message and a Confirm button. This is one of many pre-defined facilities that the CAPI offers. You can also pop up a dialog window rather than a sheet, using \texttt{prompt-with-message}.

\textbf{Note:} When you develop CAPI applications, your application windows are run in the same Window system event loop as the LispWorks IDE. This - and the fact that in Common Lisp user code exists in the same global namespace as the Common Lisp implementation - means that a CAPI application running in
the LispWorks IDE can modify the same values as you can concurrently modify from one of the LispWorks IDE programming tools.

For example, your CAPI application might have a button that, when pressed, sets a slot in a particular object that you could also set by hand in the Listener. Such introspection can be useful but can also lead to unexpected values and behavior while testing your application code.
This chapter contains information that does not belong in the more specific sections that follow, including functionality common to several (or most) pane classes. It also introduces classes allowing you to create more common windowing elements, beyond the few mentioned in Chapter 2, *Getting Started*.

Before trying out the examples in this chapter, define the functions `test-callback` and `hello` in your Listener. The first displays the list of arguments it is given, and returns `nil`. The second just displays a message.

```lisp
(defun test-callback (data interface)
  (display-message "Data ~S in interface ~S" data interface))

(defun hello (data interface)
  (declare (ignore data interface))
  (display-message "Hello World" ))
```

We will use these callbacks in the examples that follow.

### 3.1 Generic properties

Because CAPI elements are just like CLOS classes, many elements share a common set of properties. The remainder of this section describes the properties that all the classes described in this chapter inherit.
3.1.1 Scroll bars

The CAPI lets you specify horizontal or vertical scroll bars for any subclass of the `simple-pane` element (including all of the classes described in this chapter).

Horizontal and vertical scroll bars can be specified using the keywords `:horizontal-scroll` and `:vertical-scroll`. By default, both `:vertical-scroll` and `:horizontal-scroll` are `nil`.

3.1.2 Background and foreground colors

All subclasses of the simple pane element can have different foreground and background colors, using the `:background` and `:foreground` initargs. For example, including

```lisp
:background :blue
:foreground :yellow
```

in the `make-instance` of a text pane would result in a pane with a blue background and yellow text.

3.1.3 Fonts

The CAPI interface supports the use of other fonts for text in title panes and other CAPI objects, such as buttons, through the use of the `:font` keyword. If the CAPI cannot find the specified font it reverts to the default font. The `:font` keyword applies to data following the `:text` keyword. The value is a graphics ports `font-description` object specifying various attributes of the font.

On systems running X Windows, the `xlsfonts` command can be used to list which fonts are available. The X logical font descriptor can be explicitly passed as a string to the `:font` initarg, which will convert them.

Here is an example of a `title-pane` with an explicit font:
3.1 Generic properties

Here is an example of using :font to produce a title pane with larger lettering. Note that the CAPI automatically resized the pane to fit around the text.

```
(make-instance 'title-pane 
  :text "A large piece of text"
  :font (gp:make-font-description
    :family "Times"
    :size 34
    :weight :medium
    :slant :roman)))
```

Figure 3.1 An example of the use of font descriptions

3.1.4 Mnemonics

This section applies to Microsoft Windows and GTK+ only.

Underlined letters in menus, titles and buttons are called mnemonics. The user can select the element by pressing the corresponding key.

3.1.4.1 Controlling Mnemonics

For individual buttons, menus, menu items and title panes, you can use the :mnemonic initarg to control them. For example:
3 General Properties of CAPI Panes

(capi:contain (make-instance 'capi:push-button
   :data "FooBar"
   :mnemonic #\B))

For more information on mnemonics in buttons, see “Mnemonics in buttons” on page 34.

For information on controlling mnemonics in button panels, see “Mnemonics in button panels” on page 46. For information on controlling mnemonics in menus, see “Mnemonics in menus” on page 117.

The initarg :mnemonic-title allows you to specify the mnemonic in the title for many pane classes including list-panel, text-input-pane and option-pane. Also grid-layout supports mnemonic-title when has-title-column-p is true. For the details see titled-object.

3.1.4.2 Mnemonics on Microsoft Windows

On Microsoft Windows the user can make the mnemonics visible by holding down the Alt key.

Windows can hide mnemonics when the user is not using the keyboard. This is controlled in Windows 8 by

Control Panel > Ease of Access > Ease of Access Center > Make the keyboard easier to use > Underline keyboard shortcuts and access keys

and in Windows XP by

Control Panel > Display > Appearance > Effects > Hide underlined letters...

3.1.5 Focus

The focus is where keyboard gestures are sent.

You can specify that a pane should or should not get the focus by using the initarg :accepts-focus-p (defined for element). By default interactive elements except menus accept focus, and non-interactive elements do not accept focus, so normally you do not need to use :accepts-focus-p.
3.1 Generic properties

3.1.5.1 Initial focus

By default, when a window first appears the focus is in the top-left pane that accepts focus. You can override this by using the initarg `:initial-focus` or using the accessor `pane-initial-focus` on interfaces and layouts, and using the initarg `:initial-focus-item` for choices (check-button-panel for example).

3.1.5.2 Querying the focus

The function `pane-descendant-child-with-focus` can find a child pane that has the focus, when given as argument a pane with children such as a layout, an interface, or certain choices including a button-panel and toolbar.

The function `pane-has-focus-p` can be used to determine if a specific pane has the focus.

3.1.5.3 Setting the focus dynamically

The function `set-pane-focus` can be used to set the focus to a pane inside an active window. If you need to ensure that the window is active, you can use `activate-pane`, which activates the window and sets the focus. For panes that have children (as described in “Querying the focus” on page 15) the actual pane that receives the focus is the “initial focus”, as described “Initial focus” on page 15.

When `set-pane-focus` is called, just before it actually sets the focus, it calls the generic function `pane-got-focus` with the interface and the pane. You can define your own method (specialized on your own interface class) to perform any processing that may be required.

3.1.6 Mouse cursor

The mouse cursor of a pane can be specified by the initarg :cursor or accessor `simple-pane-cursor`. The cursor to be used needs to be a result of a call to `load-cursor`.

It is possible to set an "override" cursor in an interface, which sets the cursors in all its panes. That is typically used to temporarily set the cursor while the
interface is in a different input state from the normal state. This feature does not work on Cocoa.

### 3.2 Base classes

Most CAPI classes inherit from *capi-object*, which has a *plist* and a *name*. The subclasses of *capi-object* are:

- **element**
  The class of all elements that corresponding to an underlying window system element. *element* defines geometry functionality including geometry hints (see “Specifying geometry hints” on page 79), and a few other basic properties. Note however that not all subclasses of *element* correspond to an underlying element: some of them are a composition of several elements, and some of them are layout elements.
  
  Subclasses of *element* are *menu* for menus (chapter 8), and *simple-pane* for all other display elements. The subclasses contain *layout* (Chapter 6, *Laying Out CAPI Panes*), which is used to arrange CAPI elements, and *interface* (Chapter 10, *Defining Interface Classes - top level windows*), which represents a window, and classes that correspond to specific display elements like *button* (“Button elements” on page 31).

- **callbacks**
  A mixin class for active elements that need to respond to user input, defining various callbacks (“Callbacks” on page 19). *item*, *collection* and *menu-object* (parent of *menu* and *menu-component*) inherit from *callbacks*.

- **item**
  A mixin class for elements that have a single piece of text like *menu-item* and *button*. It can also be used as a way of making individual items in collections/choices (Chapter 5, *Choices - panes with items*) have their own callbacks and properties. *item* inherits from *callbacks*.

- **pinboard-object**
The superclass of pinboard objects, are lightweight graphical objects which are displayed inside *pinboard-layout* (“Creating graphical objects” on page 187).

**collection** and **subclass choice**

Choice is the mixin class for all elements that have items (Chapter 5, *Choices - panes with items*). collection (and hence choice) inherits from callbacks. The subclasses of choice that can be displayed inherit from simple-pane too.

### 3.3 Specifying titles

It is possible to specify a title for a window, or part of a window. Several of the examples that you have already seen have used titles. There are two ways that you can create titles:

- Use the title-pane class, or
- Specify a title directly to any subclass of titled-object.

#### 3.3.1 Title panes

A title-pane is a blank pane into which text can be placed in order to form a title.

```lisp
(setq title (make-instance 'title-pane
                          :visible-min-width 200
                          :text "Title"))

(contain title)
```

Figure 3.2 A title pane
3.3.2 Specifying titles directly

You can specify a title directly to all CAPI panes, using the :title keyword. This is much easier than using title-panes, since it does not necessitate using a layout to group two elements together.

Any class that is a subclass of titled-object supports the :title keyword. All of the standard CAPI panes inherit from this class. You can find all the subclasses of titled-object by using the Class Browser tool in the Lisp-Works IDE.

3.3.2.1 Window titles

Specify a title for a CAPI window by supplying the :title initarg for the interface, and access it with interface-title.

Further control over the title of your application windows can be achieved by using set-default-interface-prefix-suffix and/or specializing interface-extend-title as illustrated in “Controlling the interface title” on page 150.

You can call interface-display-title to get the string that is actually displayed (or would be displayed if the interface was displayed).

3.3.2.2 Titles for elements

The position of any title can be specified by using the :title-position keyword. Most panes default their title-position to :top, although some use :left.

You can place the title in a frame (like a groupbox) around its element by specifying :title-position :frame.

You may specify the font used in the title via the keyword :title-font.

The title of a titled-object, and its font, may be changed interactively with the use of setf, if you wish.

1. Create a push button by evaluating the code below:
3.4 Callbacks

The class **callbacks** is the superclass of all the CAPI objects that receive callback calls in response to user gestures, excluding output panes. This includes collections and choices, buttons, menus, menu components, menu items and **item-pinboard-object**. The actual interaction depends on the specific class.

The arguments that callbacks are called with can be specified by the initarg :callback-type. When the argument contain the interface, the actual interface can be specified to be another interface by using **attach-interface-for-callback**. The function **element-interface-for-callback** can be used to find which interface is going to be used in a callback.

Callbacks can be aborted using **abort-callback**.

There is more detail about the callbacks available in choices in “Callbacks in choices” on page 63.
Note: output-pane and its subclasses implement callback calls by the input-model mechanism.

3.5 Displaying and entering text

There are a variety of ways in which an application can display text, accept text input or allow editing of text by the user:

Display panes
   Show non-editable text.

Text input panes
   Used for entering short pieces of text.

Editor panes
   Used for dealing with large amounts of text such as files. Also offer full configurable editor functionality.

Rich text panes
   Support formatted text. Available on Cocoa and Microsoft Windows only.

3.5.1 Display panes

You can use a display-pane to display text messages on the screen. The text in these messages cannot be edited, so they can be used by the application to present a message to the user. The :text initarg can be used to specify the message that is to appear in the pane.

1. Create a display pane by evaluating the code below:
3.5 Displaying and entering text

(setq display (make-instance 'display-pane
   :text "This is a message"))

(contain display)

Figure 3.3 A display pane

Note that the window title, which defaults to "Container" for windows created by contain, may appear truncated.

You can access the text (get and set) of a display-pane by the accessor display-pane-text. You can access the selection by display-pane-selection-p, display-pane-selection, set-display-pane-selection and display-pane-selected-text.

3.5.2 Text input panes

When you want the user to enter a line of text, such as a search string, use a text-input-pane.

(setq text (make-instance 'text-input-pane
   :title "Search: ",
   :callback 'test-callback))

(contain text)

Figure 3.4 A text input pane

Notice that the default title position for text input panes is :left.
You can place text programmatically in the text input pane by supplying a string for the \texttt{:text} initarg, or later by calling (\texttt{(setq \textit{text-input-pane}\texttt{-text})} in the appropriate process.

You can use \texttt{set-text-input-pane-selection} to control the selection in the text input pane:

\begin{verbatim}
(setq tip (make-instance 'capi:text-input-pane
  :title "Search: 
  :text "Foo Bar Baz")

(capi:set-text-input-pane-selection tip
  (length "Foo ")
  (length "Bar")).

(capi:contain tip)
\end{verbatim}

\texttt{text-input-pane} has many callbacks which allow the program to perform various tasks as the user changes the text, the selection or the caret position, or enters/leaves the pane. It is possible to respond to specific keyboard gestures, characters or otherwise (like Up arrow). \texttt{text-input-pane} has also options for performing completion on the user input.

You can add toolbar buttons for easier user input in a \texttt{text-input-pane} via the \texttt{:buttons} initarg. This example allows the user to enter the filename of an existing Lisp source file, either directly or by selecting the file in a dialog raised by the \texttt{Browse File} button. There is also a \texttt{Cancel} button, but the default \texttt{OK} button is not displayed:

\begin{verbatim}
(capi:contain
  (make-instance
    'capi:text-input-pane
    :buttons
    (list :cancel t
      :ok nil
      :browse-file
    (list :operation :open
      :filter "*.LISP;*.LSP").

  )))
\end{verbatim}

For a larger quantity of text use \texttt{multi-line-text-input-pane}.

On Cocoa, \texttt{text-input-pane} can also be made to look like a search field, using the initarg \texttt{:search-field} and related initargs.
For entering passwords use the subclass `password-pane`, which does not display the actual characters that the user types.

### 3.5.3 Editor panes

An `editor-pane` is a pane which displays text and allows the user to edit it. The text is held and manipulated in a separate module, the Editor, which is implemented in the "EDITOR" package.

The Editor is optimized to deal with large amounts of text, whether that is because a single document contains large amount of text or because the user wants to edit many texts at the same time. It has a large set of commands that the user can invoke to perform a variety of tasks, including many kinds of editing and search operations, integration with the LispWorks IDE, and various other tasks. It also has a programmatic interface to manipulate the text, which is exported from the package "EDITOR". The user interface and the programmatic interface are both documented in the *LispWorks Editor User Guide*, and the LispWorks IDE uses `editor-pane` for editing.

The interaction of the Editor emulates either Emacs style or the native style of Mac OS X, Microsoft Windows or KDE/Gnome as appropriate. There is a global default setting (native on Windows, Emacs elsewhere), which can be set in a runtime image by the Delivery keyword `:editor-style`. In particular, you fix the style for `editor-pane` in your interfaces by defining your method for `interface-keys-style`. See the chapter "Emulation" in the *LispWorks Editor User Guide* for more detail about the different styles.

From the CAPI side you can access the editor structures that hold the text by using `editor-pane-buffer`, which returns an `editor:buffer` object which holds the text. You can then use the programmatic Editor interface to access and manipulate the text.

For example, the following code inserts the string "foo" in the end of the editor pane (really in the end of the buffer):

```lisp
(let ((buffer (capi:editor-pane-buffer editor-pane)))
  (let ((point (editor:buffers-end buffer)))
    (editor:insert-string point "foo")))
```

Above, `point` is an `editor:point` object.
Alternatively, editor commands can be executed by passing the name of an editor command to `call-editor`.

Note that the editor objects can be accessed from any process (as opposed to the CAPI elements), because they use locks. Programmers can use the locks to group several editor operations so that they happen "atomically".

It is possible to specify that an `editor-pane` has an attached Echo Area which is where non-editing interactions (for example entering a command name or filename) occur. To add an Echo Area, use the `:echo-area` initarg. Otherwise, a special window pops up when such interaction needs to occur.

The variables `*editor-cursor-active-style*`, `*editor-cursor-color*`, `*editor-cursor-drag-style*` and `*editor-cursor-inactive-style*` can be used to control the appearance of the cursor. When adding an echo area, the inactive cursor style can be controlled separately by `*editor-cursor-inactive-style*`.

An `editor-pane` can have input callbacks (before and after) and a change callback. These are described in “Editor pane callbacks” on page 24.

On the CAPI side there are few additional functions that can be used on an `editor-pane`. These are described in “Additional editor-pane functions” on page 26.

### 3.5.3.1 Editor pane callbacks

You can use the initarg `:change-callback` to specify a function which is called whenever the editor buffer under the `editor-pane` changes. The value `change-callback` can be set either by:

```lisp
(make-instance 'capi:editor-pane :change-callback ...)```

or

```lisp
(setf capi:editor-pane-change-callback)
```

The current value can be queried by the accessor `editor-pane-change-callback`.

The `change-callback` function must have signature:

```lisp
change-callback pane point old-length new-length
```
3.5 Displaying and entering text

\textit{pane} is the \texttt{editor-pane} itself.

\textit{point} is an \texttt{editor:point} object where the modification to the underlying buffer starts. \textit{point} is a temporary point, and is not valid outside the scope of the change callback. For more information about \texttt{editor:point} objects, see "Points" in the \textit{LispWorks Editor User Guide}.

\textit{old-length} is the length of the affected text following \textit{point}, prior to the modification.

\textit{new-length} is the length of the affected text following \textit{point}, after the modification has occurred.

Typical calls to the \texttt{change-callback} occur on insertion of text (when \textit{old-length} is 0) and on deletion of text (when \textit{new-length} is 0). There can be other combinations, for example, after executing the \texttt{Uppercase Region} editor command, \texttt{change-callback} be called with both \textit{old-length} and \textit{new-length} being the length of the region. The same is true for changing editor text properties.

The \texttt{change-callback} is always executed in the process of \textit{pane} (as if by \texttt{apply-in-pane-process}).

The \texttt{change-callback} is permitted to modify the buffer of \textit{pane}, and other editor buffers. The callback is disabled inside the dynamic scope of the call, so there are no recursive calls to the \texttt{change-callback} of \textit{pane}. However, changes done by the callback may trigger \texttt{change-callback} calls on other \texttt{editor-panes}, whether in the same process or in another process.

There is an example illustrating the use of \texttt{change-callback} in:

\begin{verbatim}
   (example-edit-file "capi/editor/change-callback")
\end{verbatim}

You can use the initargs :\texttt{before-input-callback} and :\texttt{after-input-callback} to add input callbacks which are called when \texttt{call-editor} is called. Note that the default \texttt{input-model} also generates calls to \texttt{call-editor}, so unless you override the default \texttt{input-model} these input callbacks are called for all keyboard and mouse gestures (other than gestures that are processed by a non-focus completer window).

In both cases (\texttt{before-input-callback} and \texttt{after-input-callback}) the argument is a function that takes two arguments: the editor pane itself and the input gesture (the second argument to \texttt{call-editor}).
call-editor may redirect gestures to another pane. For example, gestures to
an editor-pane are redirected to the echo area while it is used. In this case
before-input-callback is called more than once for the same gesture, but after-
input-callback is called only once for each gesture, on the pane that actually
processed the gesture.

3.5.3.2 Additional editor-pane functions

The contents of the buffer can be retrieved and set by editor-pane-text and
(setf editor-pane-text).

modify-editor-pane-buffer can be used to change the text and the filling at
the same time.

editor-pane-line-wrap-marker, editor-pane-line-wrap-face and
*default-editor-pane-line-wrap-marker* control the appearance of the
marker that indicates wrapping of lines that are too long.

The function editor-pane-selected-text returns the selected text (if any),
and editor-pane-selected-text-p checks if there is a selection.

You can call set-default-editor-pane-blink-rate to set the default blink
rate of the cursor on all editor panes. You can specialize editor-pane-blink-
rate to control the blink rate of specific panes, and use editor-pane-
native-blink-rate to query the blink rate of the underlying GUI system.
Note that the underlying system will normally allow the user to change this
value.

The function print-editor-buffer can be used to print the contents of the
editor buffer.

The function set-editor-parenthesis-colors can be used to control
parenthesis coloring in Lisp mode.

Editor panes support composition of characters using input methods (see com-
position-callback in output-pane) by having a default callback editor-pane-
default-composition-callback, which handles it mostly right. You can
specify your own callback, which can also call editor-pane-default-com-
position-callback to do the actual work.

The editor-pane is geared towards editing files, and in particular it tries to
guard against loss of work by keeping backup files and auto-save files, and
asking the user before closing an unsaved buffer. When you use an editor-pane for other purposes, and therefore do not need all of this functionality, you should use temporary buffers. Create a temporary buffer by supplying the initarg :buffer-name :temp, or create your own temporary buffer explicitly by (editor:make-buffer ... :temporary t).

You can make an editor-pane be non-editable by users by supplying the initarg :enabled :read-only, or completely disable it with :enabled nil.

3.6 Displaying rich text

On Microsoft Windows and Cocoa, rich-text-pane allows you to display and edit rich text. It supports character attributes such as font, size and color, and paragraph attributes such as alignment and tab-stops.

See this example:

(example-edit-file "capi/applications/rich-text-editor")

3.7 Hierarchy of panes

Every element that is displayed has a parent, which you can find by the element accessor element-parent. The ultimate ancestor is a screen, which you can find by element-screen. The element is inside some window which is associated with a CAPI interface instance (that is, an instance of subclass of interface) which is called the "top level interface" and can be found by by top-level-interface. Note that inside MDI on Microsoft Windows the top level interface is the one inside the MDI, rather than the enclosing MDI window. You can test whether an object is a top level interface by top-level-interface-p. The function element-container returns the parent of the top level interface, that is the screen outside the MDI, but the document-frame inside the MDI.

Some elements have children. You can operate on the children of an element by using map-pane-children or map-pane-descendant-children. These functions will work on any element, and they will do nothing for elements without children.

The implementation of the panes you specify may internally involve generating more panes, and element-parent, map-pane-children and map-pane-
descendant-children will find these. Thus when using these functions you cannot assume that you know the hierarchy, and you need to check if the pane that you got is the right one. For example, if you create a layout like this:

```lisp
(setq layout
  (make-instance 'capi:row-layout
    :description
    (list (make-instance 'capi:list-panel))))
```

then doing something like:

```lisp
(capi:map-pane-children layout
  #'(lambda (pane) (setf (capi:collection-items pane) nil))
```

may not work, because the list panel may not be a direct child of the layout. In most cases it is best to record the actual panes so you know where to access them (most commonly in a slot in the interface). Alternatively you can use map-pane-descendant-children with a function that checks each child pane before operating on it.

Note that all these functions give useful results only for displayed elements.

### 3.8 Accessing pane geometry

The functions simple-pane-visible-height, simple-pane-visible-width, and simple-pane-visible-size can be used to read the visible geometry of a pane. Other geometrical properties of a pane can be accessed by with-geometry, which binds variables to the various geometrical properties of the pane.

### 3.9 Special kinds of windows

#### 3.9.1 Browser pane

On Microsoft Windows and Cocoa, browser-pane implements embedding of a basic web browser. It allows you to display HTML, navigate, refresh, handle errors, redirect to another URL, and so on.
3.9.2 OLE embedding and control

On Microsoft Windows `ole-control-pane` implements embedding of OLE control components. You can also embed CAPI windows inside other applications using `ole-control-component`. You define an OLE control component (an Automation class that implements OLE Control protocols) using `define-ole-control-component`, and other (non-LispWorks) applications can use it.

3.9.3 Cocoa views and application interfaces

On Cocoa, you can use `cocoa-view-pane` to display an arbitrary Cocoa View. You can specify the name of the Cocoa view class to create, and a function that is called to initialize it. The function `cocoa-view-pane-view` can be used to access the Cocoa view after it has been created.

The class `cocoa-default-application-interface` is a special class for defining application interfaces, which gives you control of application-wide properties which are not associated with specific windows. This includes the Application menu and default menu bar items, Dock context menu, application message processing and display state of the whole application.

3.9.4 Slider, Progress bar and Scroll bar

The classes `slider` and `scroll-bar` implement panes that show the value of some quantity and allow the user to change it interactively.

`slider` is intended to be used in general for any pseudo-continuous quantity that the user should be able to manipulate.

`scroll-bar` is intended to be used for scrolling. Normally a scroll bar is specified simply by supplying the `:vertical-scroll` or `:horizontal-scroll` initarg when making the pane that needs scrolling, but in some circumstances an explicit scroll bar may be useful.

The class `progress-bar` implements a pane that shows the value of some quantity and is used to indicate progress in performing some task.

All of these classes inherit from `range-pane`, which defines the various values that are used and the orientation. In addition to the `range-pane` accessors, there is also the function `range-set-sizes` which you can use to set several values at the same time.
3 General Properties of CAPI Panes

3.9.5 Text input range

text-input-range is a special pane for entering numeric values, allowing the user to either type the number or use buttons to adjust the value.

3.9.6 Stream panes

There are three subclasses of editor-pane which handle Common Lisp streams.

3.9.6.1 Collector panes

A collector-pane displays anything printed to the stream associated with it. Background output windows, for instance, are examples of collector panes.

```lisp
(setq collector
  (make-instance 'collector-pane
      :title "Example collector pane:"))

(contain collector)

(princ "abc" (collector-pane-stream collector))
```

The collector-pane has a mechanism to temporarily make it the child of a parent switchable-layout, so the user can see the output printed into it. The functions map-typeout and unmap-typeout do the switch, and the macro with-random-typeout can be used to do both switches and to also bind a variable to the stream of the collector-pane. This mechanism is used in the LispWorks IDE to show the output of Compile Buffer and other operations.

3.9.6.2 Interactive panes

An interactive-pane is the building block on which listener-pane is built.

```lisp
(contain (make-instance 'interactive-pane
      :title "Interactive pane"))
```

You can simulate user input into an interactive-pane by interactive-pane-execute-command.
Note: `interactive-pane` is probably too difficult to use, due to the complexities involved with the interaction with the Editor. However, for its subclass `listener-pane`, the system deals with all these issues.

### 3.9.6.3 Listener panes

The `listener-pane` class is a subclass of `interactive-pane`, and allows you to create interactive Common Lisp sessions. You may occasionally want to include a listener pane in a tool (as, for instance, in the LispWorks IDE Debugger).

```lisp
(contain (make-instance 'listener-pane :title "Listener"))
```

The `listener-pane` activity would normally be interacting with the user, but you can also emulate user interaction using `listener-pane-insert-value`. Note also that since `listener-pane` is a subclass of `editor-pane`, you can use the full power of the Editor on it.

### 3.9.7 Shell pane

`shell-pane` is a pane that runs a sub-process ("shell", "console") and allows the user to interact with it.

### 3.10 Button elements

Button classes inherit from the class `button`, which defines most of the attributes of buttons. `button` inherits from `simple-pane` and `item`. Button panels can be created, and are described in Chapter 5, “Choices - panes with items”.

There are three classes of buttons:

- **push-button**
  Never selected, just invokes the callback when clicked.

- **check-button**
  Toggles between selected and unselected each time it is clicked.
3 General Properties of CAPI Panes

radio-button

When clicked is selected, and deselects all other buttons in the same panel.

A single radio-button does not really make sense and this class will normally be used only inside radio-button-panel. check-button and push-button are used both inside check-button-panel or push-button-panel and on their own. Note that when using a panel, you do not have to actually use button objects, because the panel generates them automatically, and most of the functionality of buttons can be specified in the button-panel.

The text and the data that are associated with a button are defined by the the initargs and accessor inherited from item: :data, :text, :print-function, item-data, item-text, item-print-function. The function print-capi-button can be used to find what string is displayed (or will be displayed) for a button.

The callbacks of button are inherited from callbacks (via item). The :selection-callback (the initarg :callback can be used too) is the main callback, and :retract-callback is called for deselection.

button has various initargs and accessors controlling which image(s) to display, whether it is selected and/or enabled, and whether it is a Cancel button or the default button.

3.10.1 Push buttons

The :enabled keyword can be used to specify whether or not the button should be selectable when it is displayed. This can be useful for disabling a button in certain situations.

The following code creates a push button which cannot be selected.

```
(setq offbutton (make-instance 'push-button
   :data "Button"
   :enabled nil))

(contain offbutton)
```

These setf expansions enable and disable the button:
(apply-in-pane-process
  offbutton #'(setf button-enabled) t offbutton)

(apply-in-pane-process
  offbutton #'(setf button-enabled) nil offbutton)

All subclasses of the button class can be disabled in this way.

### 3.10.2 Check buttons

Check buttons can be produced with the check-button element.

1. Enter the following in a Listener:

   (setq check (make-instance 'check-button
                       :selection-callback 'hello
                       :retract-callback 'test-callback
                       :text "Button"))

   (contain check)

   ![A check button](image)

   Figure 3.5 A check button

Notice the use of :retract-callback in the example above, to specify a callback when the element is deselected.

Like push buttons, check buttons can be disabled by specifying :enabled nil.

### 3.10.3 Radio buttons

Radio buttons can be created explicitly although they are usually part of a button panel as described in Chapter 5, Choices - panes with items. The :selected initarg is used to specify whether or not the button is selected, and the :text initarg can be used to label the button.
Although a single radio button is of limited use, having an explicit radio button class gives you greater flexibility, since associated radio buttons need not be physically grouped together. Generally, the easiest way of creating a group of radio buttons is by using a button panel, but doing so means that they will be geometrically, as well as semantically, connected.

3.10.4 Mnemonics in buttons

This section applies to Microsoft Windows and GTK+ only.

The initarg :mnemonic allows you to specify a mnemonic for a button. Alternatively you can specify the button text and its mnemonic together with the initarg :mnemonic-text, for example:

```
(contain (make-instance 'radio-button
                      :text "Radio Button"
                      :selected t))
```

For all the details see button.

3.11 Adding a toolbar to an interface

A top level interface can have a toolbar, which is typically displayed at the top of the window and follows platform-standard behavior. On Cocoa, this will be a standard foldable toolbar.

For the details see Chapter 9, “Adding Toolbars”.
### 3.12 Tooltips

A tooltip is a temporary window containing text which appears when the user positions the cursor over an element for a period. The appearance is slightly delayed and the text is usually short.

Tooltips are often used for brief help text and identification of GUI elements. For example, the "X" button alongside the Filter area in the Process Browser tool in the LispWorks IDE has a tooltip "Clear filter". Tooltips can also be used to complete the display of partially hidden text, for example in the Debugger tool Backtrace view where the display of long variable values might be truncated.

You can implement tooltips for output-panes, collections, elements, menu-items and toolbar-buttons.

#### 3.12.1 Tooltips for output panes

To implement tooltips in an output-pane, call `display-tooltip` via a :motion gesture in the pane's input-model. The tooltip text might depend on the cursor position or, in the case of a pinboard-layout, on the pinboard object under the cursor.

See this example:

```lisp
(example-edit-file "capi/graphics/pinboard-help")
```

#### 3.12.2 Tooltips for collections, elements and menu items

Supply the :help-callback initarg in an interface, along with a suitable :help-key initarg for each of its collections, elements and menu-items that should have a tooltip. help-callback should return a suitable string (which will be the tooltip text) when passed type :tooltip and the help-key.

See the manual page for interface for an example of a tooltip on a text-input-pane

#### 3.12.3 Tooltips for toolbar buttons

You can implement tooltips for a toolbar-button exactly as for collections and so on as described in “Tooltips for collections, elements and menu items”
on page 35. See the example in “Specifying tooltips for toolbar buttons” on page 130.

However, if your toolbar-buttons are grouped in a toolbar-component it is simpler to supply the :tooltips initarg. tooltips should be a list containing a string giving the tooltip text of each button in the component. See this example:

(example-edit-file "capi/applications/simple-symbol-browser")

### 3.13 Screens

A screen object (of class screen or a subclass) represents what CAPI thinks is the screen that the user sees. In principle it can be a mono-screen, but these days it is always color-screen. screen is subclass of capi-object, but not simple-pane.

You get a screen object by one of:

- Calling convert-to-screen.
- Calling element-screen on a displayed element.
- Calling screens.

convert-to-screen can take screen specification in various forms. On X GUI systems (GTK+ and Motif) this can be used to select which display to use. On Microsoft Windows on any pane that is displayed inside MDI returns the MDI document-container, but otherwise there is only one screen. On Cocoa there is always only one screen. convert-to-screen initializes the screen if needed.

From a displayed element you can find the screen by element-screen. Note that this returns the actual screen, even for a pane inside MDI.

The function screens returns a list of the currently active screens. This list is always of length 1 on Cocoa and Microsoft Windows, not including MDI.

A screen specification that convert-to-screen accepts can also be used to specify the screen on which to display an interface in a call to display.

You can find the geometry of the screen by the readers screen-width and screen-height, and its depth by screen-depth. Some physical properties
can be found by the readers screen-width-in-millimeters, screen-height-in-millimeters and the function screen-logical-resolution. screen-number returns the screen number for X11 interface (GTK+ and Motif).

The area that is actually used for display may be restricted by some parts of the screen being dedicated to global features, for example menubar on Cocoa. The area that can be used for displaying by the application is called "internal geometry", which can be found by screen-internal-geometry.

A screen may correspond to several monitors. In this case it has a "virtual geometry", which is a rectangle containing all the physical screens, which can be found by virtual-screen-geometry. The coordinates of top-level windows are with respect to this rectangle. With multiple screens, screen-internal-geometry returns the internal geometry of the first (main) monitor. You can use screen-internal-geometries to find the internal geometries of all the monitors, and screen-monitor-geometries to find all the full geometries. You can use pane-screen-internal-geometry to find the internal geometry of the monitor on which the pane is displayed.

On the X interface the screen "dies" when the X connection gets broken for whatever reason. You can check for that by calling screen-active-p, which returns true for "live" screens and false otherwise.

You can find the CAPI interfaces that are displayed on a specific screen by screen-interfaces, and the active interface (as far as CAPI is concerned) by calling screen-active-interface. Note that this interface may be obscured by windows of another application.

On Microsoft Windows using MDI, the CAPI interface are children of a document-container, which is a "screen-like" object. In particular, it can be used as the screen argument of display, the internal geometry functions return the correct values, and screen-interfaces returns the interfaces.
3 General Properties of CAPI Panes
This chapter describes general issues relating to the use of CAPI. Subsequent chapters address issues specific to the host window system, and then the use of particular CAPI elements

4.1 The correct thread for CAPI operations

All operations on displayed CAPI elements need to be in the thread (that is, the mp:process) that runs their interface. On some platforms, display and contain make a new thread. On Cocoa, all interfaces run in a single thread.

In most cases this issue does not arise, because CAPI callbacks are run in the correct thread. However, if your code needs to communicate with a CAPI window from a random thread, it should use `execute-with-interface`, `execute-with-interface-if-alive`, `apply-in-pane-process` or `apply-in-pane-process-if-alive` to send the function to the correct thread.

This is why the brief interactive examples in this manual generally use `execute-with-interface` or `apply-in-pane-process` when modifying a displayed CAPI element. In contrast, the demo example in “Connecting an interface to an application” on page 147 is modified only by callbacks which run in the demo interface’s own process, and so there is no need to use `execute-with-interface` or `apply-in-pane-process`. 
Processes started by CAPI process events in the "standard" way, that is they call \texttt{mp:general-handle-event} on objects that are sent to them by \texttt{mp:process-send}. In particular, if you want to "schedule" an event to happen in the current after the current callback returns, you can use \texttt{mp:current-process-send}. For example, if the \texttt{display-callback} of an \texttt{output-pane} sometimes needs to start another interface, it would be a bad idea to do this inside the \texttt{display-callback}, so instead of

\begin{verbatim}
    (capi:display new-interface)
\end{verbatim}

you can use

\begin{verbatim}
    (mp:current-process-send `(capi:display ,new-interface))
\end{verbatim}

which will cause it to happen later.

On systems other than Cocoa, when you run something that is lengthy inside a CAPI process, you can process events in a similar way to the way CAPI processes them by calling \texttt{process-pending-messages}, which processes all pending events and returns. However that may not always work well, because the processing of the event can do arbitrary things, so you should always consider running the lengthy computation in another process.

If your code needs to cause visible updates whilst continuing to do further computation, see “Updating windows in real time” on page 103.

\section*{4.2 Redisplay}

The setting of any CAPI property that should affect the display causes CAPI to redisplay the relevant elements. However, when what is displayed depends on a state which is not a CAPI state, and this state changes, you may need to cause CAPI to redisplay.

For example, you may have a \texttt{list-panel} where the items are some objects, and the \texttt{print-function} generates a string for each object, based on some property of the object (typically a slot value). If that property changes then the display also needs to change, but there is no way for CAPI to know that so you need to tell CAPI explicitly.

A simple way to achieve this is to set a CAPI state which will cause redisplay. For example, doing
4.3 Support for multiple monitors

(setf (capi:collection-items my-pane)
     (capi:collection-items my-pane))

leaves my-pane’s items unchanged, but because the value is set CAPI redisplay all of the items. This approach, however, is both computationally expensive when done often with large number of items, and causes flickering on screen that can be avoided.

Instead you can use one of the following functions.

- To update specific items in a choice, use `redisplay-collection-item`.
- To update menus and buttons in a window, use `redisplay-interface`.
- To update part of a `pinboard-layout`, use `redraw-pinboard-layout`.
- To update specific pinboard objects, use `redraw-pinboard-object`.
- In a `tree-view`, you can also use `tree-view-update-item` in cases when the update involves moving the child in its parent or completely removing the child.

4.2.1 Atomic redisplay

Often you need several distinct updates to the display to appear simultaneously. For example when you set the text in several elements at the same time, or you set the text of an element and then also set the background. To ensure that multiple updates appear together, wrap the macro `with-atomic-redisplay` around the updates.

4.3 Support for multiple monitors

CAPI supports positioning (and querying the position of) windows on multiple monitors.

The function `screen-monitor-geometries` supports the notion of monitor geometry. The monitor geometry includes "system" areas such as the Mac OS X menu bar and the Microsoft Windows task bar.

The functions `screen-internal-geometries` and `pane-screen-internal-geometry` support the notion of internal geometry. The internal geometry excludes the system areas.
There is a "primary monitor" which displays any system areas. The origin of the coordinate system (as returned by `top-level-interface-geometry` and `screen-internal-geometry`) is the topmost/leftmost visible pixel of the primary monitor. Thus the origin may be in a system area such as the Mac OS X menu bar.

The function `virtual-screen-geometry` returns a rectangle just covering the full area of all the monitors associated with a screen.

Note that code which relies on the position of a window should not assume that a window is located where it has just been programmatically displayed, but should query the current position. This is because the geometry includes system areas where CAPI windows cannot be displayed. For more information about this see “Resizing and positioning” on page 98.

Note also that CAPI does not currently support multiple desktops, which are called workspaces in Linux distros, and called Spaces on Mac OS X.
Some elements of a window interface contain collections of items, for example rows of buttons, lists of filenames, and groups of menu items. Such elements are known in the CAPI as collections.

In most collections, items may be selected by the user — for example, a row of buttons. Collections whose items can be selected are known as choices. Each button in a row of buttons is either checked or unchecked, showing something about the application’s state — perhaps that color graphics are switched on and sound is switched off. This selection state came about as the result of a choice the user made when running the application, or default choices made by the application itself.

The CAPI provides a convenient way of producing groups of items from which collections and choices can be made. The abstract class collection provides a means of specifying a group of items. The subclass choice provides groups of selectable items, where you may specify what initial state they are in, and what happens when the selection is changed. Subclasses of collection and choice used for producing particular kinds of grouped elements are described in the sections that follow.

All the choices described in this chapter can be given a print function via the :print-function keyword. This allows you to control the way in which items in the element are displayed. For example, passing the argument
5 Choices - panes with items

'string-capitalize to :print-function would capitalize the initial letters of all the words of text that an instance of a choice displays.

Collections and choices inherit from the abstract class callbacks, which defines callbacks that are called in response to user gestures.

Some of the examples in this chapter require the callback function test-callback and hello which were introduced in Chapter 3, “General Properties of CAPI Panes”.

5.1 Items

choices in general can take arbitrary Lisp objects as the items, and then the behavior of the items (how they are displayed, callbacks) is determined by the properties of the choice. It is possible to give individual properties to individual items by using objects of class item, which encapsulates the properties of an item in a choice. The items of a choice can be a mixture of arbitrary objects and item instances.

item has several subclasses which are intended for specific choice subclasses, and these are documented in the entries for the specific choices. The predicate itemp determines whether its argument is an instance of item.

5.2 Button panel classes

This section discusses the immediate subclasses of choice which can be used to build button panels. If you have a group of several buttons, you can use the appropriate button-panel element to specify them all as a group, rather than using push-button or check-button to specify each one separately. There are three such elements altogether: push-button-panel, check-button-panel and radio-button-panel. The specifics of each are discussed below.

5.2.1 Push button panels

The arrangement of a number of push buttons into one group can be done with a push-button-panel. Since this provides a panel of buttons which do not maintain a selection when the user clicks on them, push-button-panel is a choice that does not allow a selection. When a button is activated it causes a :selection-callback, but the button does not maintain the selected state.
5.2 Button panel classes

Here is an example of a push button panel:

```lisp
(setq push-button-panel
  (make-instance 'push-button-panel
    :items '(one two three four five)
    :selection-callback 'test-callback
    :print-function 'string-capitalize))

(contain push-button-panel)
```

Figure 5.1 A push button panel

The layout of a button panel (for instance, whether items are listed vertically or horizontally) can be specified using the `:layout-class` keyword. This can take two values: `:column-layout` if you wish buttons to be listed vertically, and `:row-layout` if you wish them to be listed horizontally. The default value is `:row-layout`. If you define your own layout classes, you can also use these as values to `:layout-class`. Layouts, which apply to many other CAPI objects, are discussed in detail in Chapter 6, “Laying Out CAPI Panes”.

5.2.2 Radio button panels

A group of radio buttons (a group of buttons of which only one at a time can be selected) is created with the `radio-button-panel` class. Here is an example of a radio button panel:

```lisp
(setq radio (make-instance 'radio-button-panel
    :items (list 1 2 3 4 5)
    :selection-callback 'test-callback))
```
5 Choices - panes with items

5.2.3 Check button panels

A group of check buttons can be created with the `check-button-panel` class. Any number of check buttons can be selected.

Here is an example of a check button panel:

```
(make-instance 'check-button-panel :items '("Red" "Green" "Blue")))
```

5.2.4 Mnemonics in button panels

On Windows and GTK+ you can specify the mnemonics (underlined letters) in a button panel with the `:mnemonics` initarg, for example:

```
(make-instance 'push-button-panel :items '(one two three many) :mnemonics '(#\O #\T #\E :none) :print-function 'string-capitalize)
```

Notice that the value `:none` removes the mnemonic.
5.2 Button panel classes

5.2.5 Programming button panels

The panels inherit the callbacks functionality from `callbacks`, most importantly the `selection-callback` and `retract-callback`, which are used as the default callbacks for the buttons.

The `items` functionality of button panel is inherited from `collection`. Typically you just use the initarg `:items` to specify the items, but in principle you can set the items dynamically. The other important functionality from `collection` is the `print-function` to define the strings that are displayed in the buttons.

Accessing the state of the buttons in `check-button-panel` and `radio-button-panel` is done by the selection functionality that is defined on `choice`. For example, making a `check-button-panel` with four buttons and the last is selected, and after two seconds selecting the first and the third:

```lisp
(progn
  (setq cbp (capi:contain
    (make-instance 'capi:check-button-panel
      :items '(1 2 3 4)
      :selected-item 4)))
  (sleep 2)
  (capi:apply-in-pane-process
    cbp
    #'(lambda ()
      (setf (capi:choice-selected-items cbp)
        '(1 3))))
```

All the button panel classes inherit from `button-panel`, which defines all the functionality of button panels. This includes a mechanism for specifying the layout of the buttons, images for the buttons, mnemonics, and also default and Cancel button. It also has an initarg `:callbacks` to define an individual selection callback for each item.

The function `set-button-panel-enabled-items` is used dynamically to enable/disable individual items in a panel.

For more control over individual buttons, some (or all) of the items in a panel may be buttons themselves (that is, instances of a subclass of `button`). The behavior on an item that is actually a button is controlled by accessing the button.
5.3 List panels

Lists of selectable items can be created with the `list-panel` class. Here is a simple example of a list panel:

```lisp
(setq list
  (make-instance 'list-panel
    :items '(one two three four)
    :visible-min-height '(character 2)
    :print-function 'string-capitalize))

(contain list)
```

Figure 5.4 A list panel
Notice how the items in the list panel are passed as symbols, and a *print-function* is specified which controls how those items are displayed on the screen.

Any item on the list can be selected by clicking on it with the mouse.

By default, list panels are single selection — that is, only one item in the list may be selected at once. You can use the *interaction* keyword to change this:

```
(setq list-panel
  (make-instance 'list-panel
    :items (list "One" "Two" "Three" "Four")
    :interaction :multiple-selection))
(contain list-panel)
```

You can add callbacks to any items in the list using the *selection-callback* keyword.

```
(setq list-panel
  (make-instance 'list-panel
    :items (list "One" "Two" "Three" "Four")
    :selection-callback 'test-callback))
(contain list-panel)
```

### 5.3.1 List interaction

If you select different items in the list, only the last item you select remains highlighted. The way in which the items in a list panel interact upon selection can be controlled with the *interaction* keyword.

The list produced in the example above is known as a single-selection list because only one item at a time may be selected. List panels are *single-selection* by default.

There are also multiple-selection and extended-selection lists available. The possible interactions for list panels are:

- *single-selection* — only one item may be selected.
- *multiple-selection* — more than one item may be selected.
- *extended-selection* — see Section 5.3.2.
To get a particular interaction, supply one of the values above to the `:interaction` keyword, like this:

```lisp
(contain
  (make-instance
    'list-panel
    :items '("Red" "Green" "Blue")
    :interaction :multiple-selection))
```

Note that `:no-selection` is not a supported choice for list panels. To display a list of items with no selection possible you should use a `display-pane`.

### 5.3.2 Extended selection

Application users often want to make single and multiple selections from a list. Some of the time they want a new selection to deselect the previous one, so that only one selection remains — just like a `:single-selection` panel. On other occasions, they want new selections to be added to the previous ones — just like a `:multiple-selection` panel.

The `:extended-selection` interaction combines these two interactions. Here is an extended-selection list panel:

```lisp
(contain
  (make-instance
    'list-panel
    :items '("Item" "Thing" "Object")
    :interaction :extended-selection))
```

Before continuing, here are the definitions of a few terms. The action you perform to select a single item is called the `selection gesture`. The action performed to select additional items is called the `extension gesture`. There are two extension gestures. To add a single item to the selection, the extension gesture is a click of the left button while holding down the **Control** key. For selecting a range of items, it is a click of the left button while holding down the **Shift** key.

### 5.3.3 Deselection, retraction, and actions

As well as selecting items, users often want to deselect them. Items in multiple-selection and extended-selection lists may be deselected.
In a multiple-selection list, deselection is done by clicking on the selected item again with either of the selection or extension gestures.

In an extended-selection list, deselection is done by performing the extension gesture upon the selected item. (If this was done using the selection gesture, the list would behave as a single-selection list and all other selections would be lost.)

Just like a selection, a deselection — or retraction — can have a callback associated with it.

For a multiple-selection list panel, there may be the following callbacks:

- `:selection-callback` — called when a selection is made.
- `:retract-callback` — called when a selection is retracted.

Consider the following example. The function `set-title` changes the title of the interface to the value of the argument passed to it. By using this as the callback to the `check-button-panel`, the title of the interface is set to the current selection. The `retract-callback` function displays a message dialog with the name of the button retracted.

1. Display the example window:
5 Choices - panes with items

(defun set-title (data interface)
  (setf (interface-title interface)
        (format nil "~A" (string-capitalize data))))

(setq check-button-panel
  (make-instance 'check-button-panel
    :items '(one two three four five)
    :print-function 'string-capitalize
    :selection-callback 'set-title
    :retract-callback 'test-callback))

(contain check-button-panel)

Figure 5.5 The example check button panel before the callback.

![Check Button Panel Before Callback](image)

2. Try selecting one of the check buttons. The window title will change:

   Figure 5.6 The example check button panel after the callback.

   ![Check Button Panel After Callback](image)

3. Now de-select the button. Notice that the retract-callback is called.

   For an extended-selection list panel, there may be the following callbacks:
   
   - :selection-callback — called when a selection is made.
   - :retract-callback — called when a selection is retracted.
   - :extend-callback — called when a selection is extended.

   Also available in extended-selection and single-selection lists is the action callback. This is called when you double-click on an item.
• :action-callback — called when a double-click occurs.

5.3.4 Selections in a list
List panels — all choices, in fact — can have selections, and you can set them from within Lisp. You can specify default settings and arrange for side-effects when a user selection is made. For the details see “Selections” on page 63.

5.3.5 Images and appearance
A list panel can include images displayed on the left of each item. To include images supply the initarg :image-function. You can use images from an image-list via the initarg :image-lists.

Additionally, state images are supported on Microsoft Windows, GTK+ and Motif, via the initarg :state-image-function and, if required, :image-lists.

A list panel can have an alternating background color on Cocoa and GTK+, when specified by the initarg :alternating-background.

5.3.6 Filters
You can add a filter to a list-panel by passing the :filter initarg.

List panel filters are used in the LispWorks IDE, for example in the Inspector tool.

When a list-panel has a filter, you can the state of the filter by using list-panel-filter-state. The accessor collection-items on a list-panel with a filter returns the items after filtering. The function list-panel-unfiltered-items can be used to retrieve all the items. (setf collection-items) resets the filter, and (setf list-panel-unfiltered-items) can be used to set the items without affecting the filter. The function list-panel-items-and-filter can be used to get or set the unfiltered items and filter state together. (setf list-panel-items-and-filter) is especially useful, because setting the items and the filters separately causes the list-panel to redisplay twice.
5.3.7 Multi-column list panels

`multi-column-list-panel` is a subclass of `list-panel` which has several columns. Each line in a `multi-column-list-panel` displays several strings corresponding to a single item. `multi-column-list-panel` takes an initarg `:item-print-functions` which specifies how to generate the strings. The initarg `:columns` specifies column properties including width, alignment, and title.

The columns can have headers, which can be active (that is, they have callbacks). In particular, the headers can be made to sort the items based on some key and comparison function, by supplying the header’s `selection-callback` as `:sort` and defining `sort-descriptions` (inherited from `sorted-object` via `list-panel`) with types that match the titles of the columns.

For an example see:

```
(example-edit-file "capi/choice/multi-column-list-panels")
```

5.3.8 Double list panel

`double-list-panel` is a choice that displays the items in two `list-panel`s side-by-side, and allows the user to move items between them. It is not a subclass of `list-panel`.

The selection interface functions (choice-selected-items, the choice accessor choice-selection, and so on) treat the items in one sub-panel as the selected items and the items in the other sub-panel as the non-selected items. `double-list-panel` takes more space, but is very convenient for the user when she needs to add or remove items from the selection, especially when there are many items.

5.3.9 Searching by keyboard input

`list-panel` has an initarg `:keyboard-search-callback` which allows you to define searches in the `list-panel` in response to user input. The function `list-panel-search-with-function` is intended to simplify writing the callback.

The default search uses a timeout to decide whether to:
• add an input character to the previous input to create the string to search, or
• search for the character.

This timeout can be set by set-list-panel-keyboard-search-reset-time.

The keyboard-search-callback can actually be used to perform other tasks in response to user keyboard input.

5.4 Trees

tree-view is a pane that displays a hierarchical list of items. Each item may optionally have an image and a checkbox.

Callbacks can be specified as for other choice classes. Additionally you can control how the nodes of the tree are expanded, and there is delete-item-callback available for use when the user presses the Delete key.

Tree views are used in the LispWorks IDE, for example in the Output Data view of the Tracer tool and the Backtrace area of the Debugger and Stepper tools.

5.4.1 Tree interaction

tree-view supports only the :single-selection interaction but you can have :extended-selection functionality by using the subclass extended-selection-tree-view.

5.4.2 Images and appearance

tree-view can include images displayed on the left of each item. To include images supply the initarg :image-function. You can use images from an image-list via the initarg :image-lists.

Additionally, state images are supported on Microsoft Windows, GTK+ and Motif, via the initarg :state-image-function and, if required, :image-lists.

A tree view can have an alternating background color on Cocoa and GTK+, when specified by the initarg :alternating-background.
5.5 Graph panes

Another kind of choice is the graph-pane. This is a special pane that can draw graphs, whose nodes and edges can be selected, and for which callbacks can be specified, as usual.

While graph-pane is a subclass of choice and hence collection, the concept of collection items is not applicable to a graph. Instead, a graph-pane has a list of "roots" (user-supplied arbitrary objects) which are specified by the initarg :roots and can be accessed later by graph-pane-roots, and a children-function. The roots define the initial nodes, and when the user expands a node, the children-function is called to compute the children, which is a list of more items, which specify the children nodes of the expanded node. Thus the actual items in the graph are changed as nodes are expanded or collapsed.

The concepts of selection, that is the functions choice-selected-items and so on, are applicable to graph-pane.

Here is a simple example of a graph pane. It draws a small rooted tree:
5.5 Graph panes

The graph pane is supplied with a :children-function which it uses to calculate the children of the root node, and from those children it continues to calculate more children until the termination condition is reached. For more details of this, see the manual page for graph-pane.

graph-pane provides a gesture which expands or collapses a node, depending on its current state. Click on the circle alongside the node to expand or collapse it.

You can associate selection, retraction, extension, and action callbacks with any or all elements of a graph. Here is a simple graph pane that has an action callback on its nodes.
First we need a pane which will display the callback messages. Executing the following form to create this pane:

```lisp
(defun test-action-callback (&rest args)
  (format (collector-pane-stream *the-collector*) "Action"))
```

Then, define the following four callback functions:

```lisp
(defun test-action-callback (&rest args)
  (format (collector-pane-stream *the-collector*) "Action"))
```

```lisp
(defun test-selection-callback (&rest args)
  (format (collector-pane-stream *the-collector*) "Selection"))
```

```lisp
(defun test-extend-callback (&rest args)
  (format (collector-pane-stream *the-collector*) "Extend"))
```

```lisp
(defun test-retract-callback (&rest args)
  (format (collector-pane-stream *the-collector*) "Retract"))
```

Now create an extended selection graph pane which uses each of these callbacks, the callback used depending on the action taken:

```lisp
(make-instance
  'graph-pane
  :interaction :extended-selection
  :roots '(1)
  :children-function
  #'(lambda (x)
      (when (< x 8)
        (list (* 2 x) (1+ (* 2 x)))))))
```

The selection callback function is called whenever any node in the graph is selected.

The extension callback function is called when the selection is extended by middle clicking on another node (thus selecting it too).
The retract callback function is called whenever an already selected node is
deselected.

The action callback function is called whenever an action is performed on a
node (that is, whenever it gets a double-click, or Return is pressed while the
node is selected).

5.5.1 Changing the graphics in the graph

graph-pane is actually a subclass of pinboard-layout, and displays the
graph using pinboard-objects. You can specify the class of these pinboard-
objects, as well as a function to actually create the object for each node. This
allows you to modify the appearance of the graph without affecting or access-
ing the topology of the graph.

5.5.2 Controlling the layout

The roots of the graph are placed at one side of the panes and the graph grows
into the pane. The side on which the roots are placed is defined by the layout-
function and accessor graph-pane-layout-function, which takes one of the
keyword values :left-right, :top-down, :right-left and :bottom-up,
where the first word in a keyword is the side where the roots are placed. There
is also an accessor graph-pane-direction, which maps :forward to/from :
left-right and :left-right, and maps :backward to/from :right-left
and :bottom-up, which makes it easier to set the direction without changing
the vertical/horizontal dimension.

5.5.3 Accessing the topology of the graph

The topology of the graph is represented by graph-node objects and graph-
edge objects. The list of graph-nodes and graph-edges of the graph-pane
can be found by graph-pane-edges and graph-pane-nodes. Note, however,
that these are subject to change as the user interacts with the graph.

You can find the node associated with an item (if any) by using find-graph-
node. You can find the children of a supplied node by graph-node-children.
You can find the edges from the node (that is, to its children) by the reader
graph-node-out-edges, and edges in by graph-node-in-edges. You can
also search for an edge between a parent and child by find-graph-edge.
From a graph-edge, you can find the the parent and child that are connected by it by the accessors graph-edge-from and graph-edge-to respectively. It is possible to select specific nodes by graph-pane-select-graph-nodes, which takes a predicate that is applied to all the nodes.

You can find the geometry of a node, that is the part of the pane occupied by the pinboard-object that is associated with the node, by the graph-node readers graph-node-x, graph-node-y, graph-node-height and graph-node-width. You can find whether a point in the pane is within the area of a graph object, either a graph-node or graph-edge, by using graph-pane-object-at-position.

It is possible to modify the graph explicitly by graph-pane-delete-object, graph-pane-delete-objects, graph-pane-delete-selected-objects and graph-pane-add-graph-node. However, that will be overridden next time the graph-pane computes the layout.

The user can interactively move nodes (and hence also edges) in the graph. If you need to know when that happens, you make a subclass of graph-pane, and then specialize graph-pane-update-moved-objects on it.

### 5.6 Option panes

Option panes, created with the option-pane class, display the current selection from a single-selection list. When the user clicks on the option pane, the list appears and the user can make another selection from it. Once the selection is made, it is displayed in the option pane. In contrast to text-input-choice, the user cannot edit the selection.

The appearance of the option-pane list varies between platforms: a dropdown list box on Microsoft Windows; a combo box on GTK+ or Motif, and a popup list on Cocoa.

Here is an example option pane, which shows the choice of one of five numbers. The initial selection is controlled with :selected-item.
5.7  Text input choice

(contain
(make-instance
 'option-pane
 :items '(1 2 3 4 5)
 :selected-item 3
 :title "One of Five:"))

Figure 5.8  An option pane

5.6.1  Option panes with images

You can add images to option pane items. Supply the :image-function ini-
targ when creating the option-pane, as illustrated in:

(example-edit-file "capi/choice/option-pane-with-images")

5.7  Text input choice

The text-input-choice class allows arbitrary text input augmented with a
choice like an option-pane. The user can edit the text after selecting it from
the list.

See this example:

(example-edit-file "capi/elements/text-input-choice")

5.8  Menu components

Menus (covered in Chapter 8) can have components that are also choices.
These components are groups of items that have an interaction upon selection
just like other choices. The :interaction keyword is used to associate radio
or check buttons with the group — with the values :single-selection and
:multiple-selection respectively. By default, a menu component has an
interaction of :no-selection.
See “Grouping menu items together” on page 111 for more details.

5.9 General properties of choices
This section summarizes the general properties of choices.

5.9.1 Interaction
All choices have an interaction style, controlled by the :interaction initarg. The radio-button-panel and check-button-panel are simply button-panels with their interactions set appropriately. The possible values for interaction are listed below.

::single-selection
Only one item may be selected at a time: selecting an item deselects any other selected item.

::multiple-selection
A multiple selection choice allows the user to select as many items as she wants. A selected item may be deselected by clicking on it again.

::extended-selection
An extended selection choice is a combination of the previous two: only one item may be selected, but the selection may be extended to more than one item.

::no-selection
Forces no interaction. Note that this option is not available for list panels. To display a list of items with no selection you should use a display pane instead.

Specifying an interaction style that is invalid for a particular choice causes an error.

The accessor choice-interaction is provided for accessing the interaction of a choice.
5.9 General properties of choices

5.9.2 Selections

All choices have a selection. This is a state representing the items currently selected. The selection is represented as a list of indexes into the list of the choice’s items, unless it is a single-selection choice, in which case it is just represented as an index. The indexes in the selection can be used to access the actual items using `get-collection-item`.

The initial selection is controlled with the initarg `:selection`. The choice accessor `choice-selection` is provided, and you can also use `(setf choice-selection)`.

Generally, it is easier to refer to the selection in terms of the items selected, rather than by indexes, so the CAPI provides the notion of a selected item and the selected items. The first of these is the selected item in a single-selection choice. The second is a list of the selected items in any choice.

The accessors `choice-selected-item` and `choice-selected-items` provide access to these conceptual slots, and you can also supply the values at `make-instance` time via the initargs `:selected-item` and `:selected-items`.

5.9.3 Callbacks in choices

All choices can have callbacks associated with them. Callbacks are invoked both by mouse button presses and keyboard gestures that change the selection or are “Action Gestures” such as Return. Different sorts of gesture can have different sorts of callback associated with them.

The following callbacks are available: `:selection-callback`, `:retract-callback` (called when a deselection is made), `:extend-callback`, `:action-callback` (called when a double-click occurs) and `:alternative-action-callback` (called when a modified double-click occurs). What makes one choice different from another is that they permit different combinations of these callbacks. This is a consequence of the differing interactions. For example, you cannot have an `:extend-callback` in a radio button panel, because you cannot extend selection in one.

Callbacks pass data to the function they call. There are default arguments for each type of callback. Using the `:callback-type` keyword allows you to change these defaults. Example values of `callback-type` are `:interface` (which
causes the interface to be passed as an argument to the callback function),
:data (the value of the selected data is passed), :element (the element
containing the callback is passed) and :none (no arguments are passed). Also
there is a variety of composite :callback-type values, such as :data-
interface (which causes two arguments, the data and the interface, to be
passed). For a complete description of :callback-type values, see the man-
ual page for callbacks.

The following example uses a push button and a callback function to display
the arguments it receives.

```lisp
(defun show-callback-args (arg1 arg2)
  (display-message "The arguments were ~S and ~S" arg1 arg2))

(setq example-button (make-instance 'push-button
  :text "Push Me"
  :callback 'show-callback-args
  :data "Here is some data"
  :callback-type :data-interface))
```

Try changing the :callback-type to other values.

If you do not use the :callback-type argument and you do not know what
the default is, you can define your callback function with lambda list (\&rest
args) to account for all the arguments that might be passed.

Specifying a callback that is invalid for a particular choice causes an error.

5.9.4 image-list, image-set and image-locator

Choices that need images for displaying items generally have an slot image-
function which holds a function that returns the image to use for an item. The
return value ultimately needs to evaluate to an image to display, but there are
various ways to specify it. These include all the specifications that load-
image understands. In addition, they can also be an integer which is an index
into an image-list or an image-locator.

To use image-list in a choice you need to specify the image-list by the
appropriate initarg, for example :image-lists for tree-view. See the entry
for each specific class. Once the choice has image-lists, the image-function can return an index into the relevant list.

An image-list is an object that specifies an ordered set of images with a common width and common height. The images in the image-list can be image objects, image identifiers (pathname or symbol, which are automatically loaded by load-image), or image-set objects. You need to supply these objects when you make the image-list by cl:make-instance.

An image-list object can be used repeatedly in several panes. It is useful because it simplifies the handling of the images.

Example:

(example-edit-file "capi/choice/tree-view")

An image-set represents a group of images of the same size that are derived from a single object. For example, six images of 16x16 pixels each can be derived from a single image of 16x96 pixels. This is an example of the "general" image-set, which is created by make-general-image-set. In addition, you can create a scaled image set by either make-scaled-general-image-set or make-scaled-image-set. On Microsoft Windows, you can also create image-sets from resources in a DLL, either a bitmap resource by make-resource-image-set, or icon resource by make-icon-resource-image-set.

image-sets are useful because it is often convenient to hold a group of images as a combined larger image, which reduces the number of objects that needed to be dealt with. image-sets are used inside image-lists, and sometimes can be used directly, for example in toolbar. image-set can also be used in image-locators.

Examples:

(example-edit-file "capi/choice/tree-view")
(example-edit-file "capi/elements/toolbar")
(example-edit-file "capi/choice/multi-column-list-panels")

An image-locator specifies one image out of an image-set, and it is created by make-image-locator. It can be used instead of an image in various places, most usefully as a result of the various image-functions.

Example:
For choices like tree-view or list-panel, you can include a sub-set from an image-set either by using image locators, or by including the image-set in an image-list and use the image-list in the choice. The latter technique is normally more convenient when all the image-set is used, but in other situations using image-locators may be more convenient.

5.10 Operations on collections (choices) and their items

This section describes how you can access the items of a collection. In practice you will perform these operations on instances of subclasses of choice.

5.10.1 Accessing items

Given a collection and an index, you can retrieve the actual items in the collection by get-collection-item. Find the number of items in a collection at any point by count-collection-items. map-collection-items can be used to map a function over the collection items. print-collection-item can be used to "print" an item, that is generate the same string that will be displayed for this item. The collection accessor collection-items returns a list of the items in the collection, and can be used with setf to set the items.

5.10.2 Efficient manipulation of collection items

It is always possible to modify all the items of a collection by calling

(setf collection-items)

on it. However that can be expensive when called often with large numbers of items, and can cause flickering on screen. For typical choices (when items-get-function is svref), it is possible to modify the items of the choice more efficiently by using one of replace-items, remove-items or append-items.

Note: graph-pane and tree-view are not "typical" (their items-get-function is not svref) and therefore these functions cannot be used on these panes.

5.10.3 Searching in a collection

The function search-for-item can be used to find an item in a collection.
5.10 *Operations on collections (choices) and their items*

`find-string-in-collection` can be used to find a string in the printed items (that is, in the result of calling the print function). There is also `collection-find-string` which prompts the user for the string and then searches, and `collection-find-next-string` to continue the search from the previous match. `collection-last-search` can be used to retrieve the last search string, if any.
5 Choices - panes with items
The CAPI provides various layout classes which allow you to combine multiple window elements in a single window. This chapter provides an introduction to the different classes of layout available and the ways in which each can be used.

Layouts are created just like any other CAPI element, by calling `make-instance`. Each layout needs to have a description which is a list of the CAPI elements it contains. The description can be supplied via the `:description` initarg. It can also be supplied or modified later by calling `(setf layout-description)` in the layout’s process. The description is interpreted by `interpret-description` as specifying a list of elements which are the "children" of the layout. The layout groups its children on the screen and specifies their geometry (x and y coordinates of top-left corner, width and height).

Only CAPI elements can be layout children. In this chapter "children" or "child" refers only to elements of these types:

- Instances of `simple-pane` and its subclasses.
- Instances of `pinboard-object` and its subclasses (discussed in Chapter 12, “Creating Panes with Your Own Drawing and Input”).

For example, to put elements one above the other you make an instance of class `column-layout` with the elements as its `description`: 
(defun put-in-a-column (list-of-elements)
  (make-instance 'column-layout
    :description list-of-elements))

Since the result is a layout, you can put it in an interface and display it:

(defun display-in-a-column (list-of-elements)
  (display
   (make-instance 'interface
     :layout (put-in-a-column list-of-elements))))

(display-in-a-column
  (list (make-instance 'text-input-pane
    :text "Text input pane"
  (make-instance 'push-button
    :data "Button"))

(display-in-a-column
  (loop for x below 10
     collect
     (make-instance 'push-button
       :data (format nil "Button No. ~d" x))))

Layout themselves are subclasses of simple-pane, and hence can be children of other layouts, creating a hierarchical "tree" of layouts with other types of children as the "leaves". This is the normal way of laying out all the elements inside an interface. interface is also a subclass of simple-pane and can appear in the hierarchy, though usually interface is used only for the top-level window.

In general, the layouts need to know their childrens’ geometrical requirements. These requirements are referred to as "constraints" and include the minimum and maximum width and height. Some of the child classes have default constraints, for example text-input-pane by default has both minimum and maximum height which allows showing one line, taking into account the height of the font. Most child classes do not have default constraints, and in effect have a minimum dimension of 0 and no maximum. Quite often that is good enough, but not always.

You can override the default constraints of an element by specifying geometrical "hints" (the word "constraint" is sometimes used to refer to the hint). Hints can be specified in many ways, for example the minimum width can be specified as enough to display 30 characters. Geometrical hints are typically specified by initargs when making a pane, but you can also set them dynamically.
See “Specifying geometry hints” on page 79 for details. In most cases, specifying the hints is sufficient (once you specify the hierarchy of layouts).

The function get-constraints computes the constraints in pixels based on the hints or the defaults, and returns the min/max of the width and height. Note that the result of get-constraints is dependent both on the hints themselves and other factors. For example, if the minimum width of an element is specified as “30 characters”, changing the font of the element will cause get-constraints to return a different value. For more complex computations, it is also possible to define a calculate-constraints method, but in most cases the geometry hints are enough.

The layouts in general use get-constraints to get the constraints of their children, and take them into account when calculating the geometry of the elements and its own implicit constraints. For example, a row-layout puts elements side-by-side, and if it has two children with minimum width and height of 100, it will have an implicit minimum width of 200 and implicit minimum height of 100. The implicit constraints are used by get-constraints on the layout itself (by its parent), unless they are overridden by geometry hints or calculate-constraints on the layout.

The process of laying out starts at the top of the hierarchy, with the outer layout calling get-constraints on its children. If any of the children is a layout itself, it calls get-constraints of its children. Thus the get-constraints call is propagated down the hierarchy to all the tree, and the results are propagated back. Then the top layout lays out its children, that is it tells them their geometry, and again this is propagated down by each child which is a layout itself.

When a layout lays out its children, its uses its own geometry, the children’s constraints and a layout-specific algorithm, which is implemented by calculate-layout. Thus when the documentation describes a layout of some class as “laying out its children in some way” it really means that this is what the applicable method of calculate-layout tries to achieve. Note that calculate-layout does not necessarily obey the constraints, and even the methods that intend to obey the constraints may fail to do so. For example, a row-layout with two children each of minimum width 100 which is given a width of 150 pixels will give only 50 to the second child. Conversely, when the layout
has more space that the minimum required it usually distributes space between the elements that are not constrained by a maximum.

`calculate-layout` records the layout that it computed by setting the $x$, $y$, $width$, and $height$ in the geometries of the children (using `with-geometry`). The system then displays the children with the new geometry.

The hierarchy of layouts is laid out from the top layout of the top level interface when the interface is being displayed. After that, whenever the program makes a change to any element which may change its constraints, the system goes up the hierarchy until it finds a layout that it can tell is not going to need to change its constraints, and then lays out the children of that layout, as described above.

You can tell CAPI that the constraints of a pane may have changed and need to be recomputed (and hence maybe part of the hierarchy needs re-layout) by calling `invalidate-pane-constraints`.

Once again, you should make sure you have defined the `test-callback` function before attempting any of the examples in this chapter. Its definition is repeated here for convenience.

```
(defun test-callback (data interface)
  (display-message "Data ~S in interface ~S" data interface))
```

### 6.1 Organizing panes in columns and rows

You will frequently need to organize a number of different elements in rows and columns. The `column-layout` and `row-layout` elements are provided to make this easy.

The following is a simple example showing the use of `column-layout`. 
6.1 Organizing panes in columns and rows

```
(contain (make-instance 'column-layout
    :description (list
        (make-instance 'text-input-pane)
        (make-instance 'list-panel
            :items '(1 2 3 4 5))))))
```

Figure 6.1 An example of using `column-layout`

1. Define the following elements:
   ```lisp
   (setq button1 (make-instance 'push-button
       :data "Button 1"
       :callback 'test-callback))
   (setq button2 (make-instance 'push-button
       :data "Button 2"
       :callback 'test-callback))
   (setq editor (make-instance 'editor-pane
       :text "An editor pane"))
   (setq message (make-instance 'display-pane
       :text "A display pane"))
   ```
(setq text (make-instance 'text-input-pane
    :title "Text: 
    :title-position :left
    :callback 'test-callback))

These will be used in the examples throughout the rest of this chapter.

To arrange any number of elements in a column, create a layout using `column-layout`, listing the elements you wish to use. For instance, to display `title`, followed by `text` and `button1`, enter the following into a Listener:

```
(contain (make-instance 'column-layout
    :description
    (list text button1)))
```

Figure 6.2 A number of elements displayed in a column

To arrange the same elements in a row, simply replace `column-layout` in the example above with `row-layout`. If you run this example, close the column layout window first: each CAPI element can only be on the screen once at any time.

Layouts can be given horizontal and vertical scroll bars, if desired; the keywords `:horizontal-scroll` and `:vertical-scroll` can be set to `t` or `nil`, as necessary.

When creating panes which can be resized (for instance, list panels, editor panes and so on) you can specify the size of each pane relative to the others by listing the proportions of each. This can be done via either the `:y-ratios` keyword (for column layouts) or the `:x-ratios` keyword (for row layouts).
6.1 Organizing panes in columns and rows

```
(contain (make-instance 'column-layout
    :description (list
      (make-instance 'display-pane)
      (make-instance 'editor-pane)
      (make-instance 'listener-pane))
    :y-ratios '(1 5 3)))
```

You may need to resize this window in order to see the size of each pane.

Note that the heights of the three panes are in the proportions specified. The `:x-ratios` initarg will adjust the width of panes in a row layout in a similar way.

It is also possible to specify that some panes are fixed at their minimum size while others in the same row or column adjust proportionately when the interface is resized:

```
(contain
  (make-instance 'column-layout
    :description (list
      (make-instance 'output-pane
        :background :red
        :visible-min-height '(:character 1))
      (make-instance 'output-pane
        :background :blue
        :visible-min-height '(:character 1))
      (make-instance 'output-pane
        :background :red
        :visible-min-height '(:character 3)))
    :y-ratios '(1 nil 3)
    :title "Resize this window vertically: the red panes maintain ratio 1:3, while the blue pane is fixed."
))
```

To arrange panes in your row or column layout with constant gaps between them, use the `:gap` initarg:
6.2 Other types of layout

Row and column layouts are the most basic type of layout class available in the CAPI, and will be sufficient for many things you want to do. A variety of other layouts are available as well, as described in this section.

6.2.1 Grid layouts

Row and column layouts only allow you to position a pane horizontally or vertically (depending on which class you use), but grid layouts let you specify both thus allowing you to create a complete grid of different CAPI panes.

grid-layout supports a title column, as illustrated in
6.3 Combining different layouts

and it supports cells spanning multiple columns or rows, as illustrated in

(grid-layout (and its subclasses column-layout and row-layout) is a subclass of x-y-adjustable-layout, which allows you to specify adjustments when you position the pane using the initargs :x-adjust and :y-adjust.

6.2.2 Simple layouts

A simple-layout has only one child. Where possible, the child is resized to fit the layout. Simple layouts are sometimes useful when you need to encapsulate a pane.

6.2.3 Pinboard layouts

Pinboard layouts allow you to position a pane anywhere within a window, by specifying the x and y integer coordinates of the pane precisely. They are a means of letting you achieve any effect which you cannot create using the other available layouts, although their use can be correspondingly more complex. They are discussed in more detail in Chapter 12, “Creating Panes with Your Own Drawing and Input”.

6.3 Combining different layouts

You will not always want to arrange all your elements in a single row or column. You can include other layouts in the list of elements used in any layout, thus enabling you to specify precisely how panes in a window should be arranged.

For instance, suppose you want to arrange the elements in your window as shown in Figure 6.3. The two buttons are shown on the right, with the text
input pane and a message on the left. Immediately below this is the editor pane.

Figure 6.3  A sample layout

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Message</td>
<td>Button1</td>
</tr>
<tr>
<td>Text</td>
<td>Button2</td>
</tr>
</tbody>
</table>

The layout in Figure 6.3 can be achieved by creating two row layouts: one containing the display pane and a button, and one containing the text input pane and the other button, and then creating a column layout which uses these two row layouts and the editor.

```lisp
(setq row1 (make-instance 'row-layout :description (list message button1)))
(setq row2 (make-instance 'row-layout :description (list text button2)))
```
6.4 Specifying geometry hints

If you do not specify any hints, the CAPI uses the default constraints. In many cases that gives useful geometry already.

When you do need to specify the constraints, the normal way is to specify the hints for the element(s) when making them by passing the appropriate keywords. The available keywords and their meanings are explained in “Width and height hints” on page 80, and the potential values are explained in “Hint values formats” on page 83.

It also possible to set the hints later, either by set-geometric-hint to set a single hint or set-hint-table to set all of them.

As you can see, creating a variety of different layouts is simple. This means that it is easy to experiment with different layouts, allowing you to concentrate on the interface design, rather than its code.

However, remember that each instance of a CAPI element must not be used in more than one place at the same time.

Figure 6.4 An instantiation of the sample layout

```
(contain (make-instance 'column-layout
    :description
    (list row1 row2 editor)))
```
It is also possible to specify initial constraints, which are applicable during the creation of the window, but not later. Typically that is used to force the initial window to be large enough, but later allowing the user to reduce the size.

### 6.4.1 Width and height hints

In CAPI, there are three kinds of geometry dimensions: external, visible and internal.

External and visible dimensions are two different ways to specify the dimensions of an element on the screen. The external dimension specifies the size of the element including its borders, while the visible dimension specifies the size of the pane inside its borders. Thus

\[
\text{external-width} = \text{visible-width} + \text{borders-width} \\
\text{external-height} = \text{visible-height} + \text{borders-height}
\]

For a non-scrolling pane, internal dimensions mean the same as visible. For a scrolling pane, internal dimensions specify the size that the pane would need to display all of its data. For example, a `list-panel` with 100 items of which exactly 30 items are fully visible and each line is 15 pixels high has internal height of 100 x 15 = 1500 pixels and visible height of 30 x 15 = 450 pixels.

To get the right layout on the screen, you typically need to specify constraints on the width and height on the screen, which you do by specifying either the external constraints or visible constraints. This is the main way of using constraints.

The internal dimensions are needed only to compute the size of the scrollbars. Most elements implicitly compute their own internal dimensions. You should specify the minimum internal dimensions by :scroll-height and :scroll-width when you have an `output-pane` with scrollbar(s) which does ordinary scrolling (the default), so the pane can compute the size of the scrollbars. However, you can use `set-horizontal-scroll-parameters` and `set-vertical-scroll-parameters` instead.

The following keywords are used to specify geometrical constraints.

External constraints control the size that the pane takes up in its parent:

:external-min-width — the minimum width of the child in its parent
6.4 Specifying geometry hints

:external-max-width — the maximum width of the child in its parent
:external-min-height — the minimum height of the child in its parent
:external-max-height — the maximum height of the child in its parent

Visible constraints control the size of the part of the pane that you can see:
:visible-min-width — the minimum visible width of the child.
:visible-max-width — the maximum visible width of the child.
:visible-min-height — the minimum visible height of the child.
:visible-max-height — the maximum visible height of the child.

If the visible-max-width is the same as the visible-min-width, then the element is not horizontally resizable. If the visible-max-height is the same as the visible-min-height, then the element is not vertically resizable.

Internal constraints control the size of region used to display the contents of the pane: These are all deprecated.

:internal-min-width — the minimum width of the display region.
:internal-max-width — the maximum width of the display region.
:internal-min-height — the minimum height of the display region.
:internal-max-height — the maximum height of the display region.

In addition, methods for the generic function calculate-constraints can be defined on your pane classes to compute the internal geometries. Note that when scrolling the :internal-max-width and :internal-max-height are not meaningful and are ignored.

For a scrolling pane, the internal constraints control the size of region over which you can scroll and the visible constraints control the size of the viewport. Here is an illustration of the external, internal and visible sizes in a
scrolling list panel with 8 items, 4 of which are fully visible and 1 is partially visible:

Figure 6.5 External, visible and internal sizes:

Initargs :min-width, :max-width, :min-height and :max-height are deprecated. They are synonyms for the visible constraints :visible-min-width and so on.

It is often wrong to constrain CAPI elements to fixed pixel sizes, as these constraints may lead to poorer layouts in some configurations.

### 6.4.1.1 Priority of constraints

The order of priority is the order in "Width and height hints" on page 80. That is, for a non-scrolling pane when there is only one independent constraint the preference order is:

- External > Visible > Internal > calculate-constraints

For a scrolling pane where there are two independent constraints the preference order for the external constraint is:

- External > Visible
and the preference order for the internal constraint is:

Internal > calculate-constraints

### 6.4.2 Hint values formats

The possible values for the hints listed in “Width and height hints” on page 80 are as follows:

- **integer**: The size in pixels.
- **t**: For :visible-max-width, t means use the value of :visible-min-width. For :visible-max-height, t means use the value of :visible-min-height.
- **:text-width**: The width of any text in the element.
- **:text-height**: The height of any text in the element.
- **:screen-width**: The width of the screen.
- **:screen-height**: The height of the screen.

A list starting with any of the following operators, followed by one or more hints:

- **max**: the maximum size of the hints.
- **min**: the minimum size of the hints.
- **+**: the sum of the hints.
- **-**: the subtraction of hints from the first.
- *****: the multiplication of the hints.
- **/**: the division of hints from the first.

A two element list specifying the size of a certain amount of text when drawn in the element:

- (**:character integer**): the size of integer characters.
- (**character integer**): the size of integer characters.
- (**:string string**): the size of string.
(string string) — the size of string.

A two-element list starting with symbol-value, and containing one other symbol:

(symbol-value foo) — the size of the symbol-value of foo.

A list starting with apply or funcall, followed by a symbol and arguments:

(apply function arg1 arg2 ...) — the result of applying the function function to the arguments.
(funcall function arg1 arg2 ...) — the result of calling the function function with the arguments.

6.4.3 Initial constraints

You can use the initarg :initial-constraints to specify constraints that apply during creation of the element’s interface, but not after the interface is displayed.

initial-constraints must be a plist of constraints, where the keywords are geometry hints as described above.

For example, this creates a window that starts at least 600 pixels high, but can be made shorter by the user, because that initial constraint is transient. However, the permanent height constraints on the two output panes remain in effect:

(make-instance 'output-pane :visible-min-height 100 :background :red)
(make-instance 'output-pane :visible-min-height 200 :background :blue))

:initial-constraints '(:visible-min-height 600))
6.5 Constraining the size of layouts

The size of a layout (often referred to as its geometry) is calculated automatically on the basis of the size of each of its children. The algorithm used takes account of hints provided by the children, and from the description of the layout itself. Hints are specified via the panes’ initargs when they are created. The various pane classes have useful default values for these initargs.

6.5.1 Default Constraints

If you do not specify any hints, the CAPI calculates the on-screen geometry based on its default constraints. With this geometry the various elements are displayed with adequate space in the window.

This is designed to work regardless of variable factors such as the user’s configuration, for example specifying large font sizes. It is often wrong to constrain CAPI elements to fixed pixel sizes, as these constraints may lead to poorer layouts in some configurations.

For information about the effect of constraints on scrolling, see “Width and height hints” on page 80.

6.5.2 Constraint Formats

Hints can take arguments in a number of formats, which are described in full under “Hint values formats” on page 83. When given a number, this should be an integer and the layout is constrained to that number of pixels. A constraint can also be specified in terms of character widths or heights, as shown in the next section.

6.5.2.1 Character constraints

In “Combining different layouts” on page 77, you created a window with five panes, by combining row and column layouts. Now consider changing the definition of the editor pane so that it is required to have a minimum size. This would be a sensible change to make, because editor panes need to be large enough to work with comfortably.
Laying Out CAPI Panes

(setq editor2
  (make-instance 'editor-pane
    :text "An editor pane with minimum size"
    :visible-min-width '(:character 30)
    :visible-min-height '(:character 10)))

Now display a window similar to the last example, but with the `editor2` editor pane. Note that it is only the description of the top-level column layout which differs. Before entering the following into the listener, you should close all the windows created in this chapter in order to free up the instances of `button1`, `button2` and so forth.

(contain (make-instance 'column-layout
  :description
  (list row1 row2 editor2)))

You will not be able to resize the window any smaller than this:

Figure 6.6 The result of resizing the sample layout
6.5.2.2 String constraints

To make a pane that is wide enough to accommodate a given string, use the :visible-min-width hint with a (:string string) constraint.

In this example we also supply :visible-max-width t, which fixes the maximum visible width to be the same as the minimum visible width. Hence the pane is wide enough, but no wider:

```lisp
(defvar *text* "Exactly this wide")

(capi:contain
 (make-instance 'capi:text-input-pane
   :text *text*
   :visible-min-width '(:string ,*text*)
   :visible-max-width t
   :font (gp:make-font-description
          :size (+ 6 (random 30)))))
```

Note that the width constraint works regardless of the font used.

6.5.3 Changing the constraints

If you need to alter the constraints on an existing element, use the function set-hint-table. See how the interface in “Character constraints” on page 85 resizes after this call:

```lisp
(apply-in-pane-process editor2
  'set-hint-table editor2 '(:visible-min-width (:character 100)))
```

If you define your own pinboard-object class, ensure that its hint table matches the visible geometry and is kept synchronised after any movement of the object, otherwise redrawing may be incorrect.

Similarly if you draw pinboard objects under a transform, call set-hint-table with the transformed geometry to ensure correct redrawing.

6.6 Other pane layouts

The example below uses three predefined panes, which need to be defined as follows:

```lisp
(setq red-pane (make-instance 'output-pane
   :background :red))
```
6.6.1 Switchable layouts

A switchable layout allows you to place CAPI objects on top of one another and determine which object is displayed on top through Lisp code, possibly linked to a button or menu option through a callback. Switchable layouts are set up using a switchable-layout element in a make-instance. As with the other layouts, such as column-layout and row-layout, the elements to be organized are listed in the description slot, initialized in this example by the :description initarg:

```lisp
(setq switching-panes (make-instance 'switchable-layout
    :description (list red-pane green-pane)))
(contains switching-panes)
```

Note that the default pane to be displayed is the red pane, which was the first pane in the description list. The two panes can now be switched between using switchable-layout-visible-child:

```lisp
(apply-in-pane-process
  switching-panes #'(setf switchable-layout-visible-child)
  green-pane switching-panes)

(apply-in-pane-process
  switching-panes #'(setf switchable-layout-visible-child)
  red-pane switching-panes)
```

6.6.2 Tab layouts

A tab-layout displays several tabs, and a single pane which contains the main contents.

In its simplest mode, a tab-layout is similar to a switchable layout, except that each pane is provided with a labelled tab, like the tabs on filing cabinet folders or address books. If the tab is clicked on by the user, the pane it is
attached to is pulled to the front. Remember to close the switchable layout window created in the last example before displaying this:

```lisp
(setq tab-layout
  (make-instance 'tab-layout
    :items (list (list "one" red-pane)
                (list "two" green-pane)
                (list "three" blue-pane))
    :print-function 'car
    :visible-child-function 'second))

(contain tab-layout)
```

Figure 6.7 A tab layout
The example needs the `:print-function` to be `car`, or else the tabs will be labelled with the object numbers of the panes as well as the title provided in the list.

However, a tab layout can also be used in a non-switchable manner, with each tab responding with a callback to alter the appearance of only one pane. In this mode the `:description` keyword is used to describe the main layout of the tab pane. In the following example the tabs alter the choice of starting node for one graph pane, by using a callback to the `graph-pane-roots` accessor:

```lisp
(defun tab-graph (items)
  (let* ((gp (make-instance 'graph-pane))
         (tl (make-instance 'tab-layout
                           :description (list gp)
                           :items items
                           :visible-child-function nil
                           :print-function (lambda (x) (format nil "~R" x))
                           :callback-type :data
                           :selection-callback #'(lambda (data)
                                                  (setf (graph-pane-roots gp)
                                                        (list data))))))
    (contain tl)))

(tab-graph '(1 2 4 5 7))
```

You can access the pane that is currently displayed in the `tab-layout` by `tab-layout-visible-child`, and you can obtain a list of the panes that have been displayed by calling `tab-layout-panes`.

### 6.6.3 Dividers and separators

If you need adjacent panes in a row or column to have a narrow user-movable divider between them, supply the special value `:divider` in the `description`. The divider allows the user to resize one pane into the space of the other. To see this in the column layout below, grab the divider between the two panes and then drag it vertically to resize both panes:

```lisp
(contain (make-instance 'column-layout
                   :description (list green-pane
                                 :divider red-pane)))
```

The arrow keys can also be used to move the divider.
To include a narrow visible element between adjacent panes which cannot be moved (dragged) by the user, supply the special value :separator in the description.

If you also specify ratios, the ratio for each occurrence of either of these special values should be nil to specify that the narrow element is fixed at its minimum size:

```
(contain (make-instance 'column-layout
 :description (list
   (make-instance 'output-pane
     :background :red)
   :divider
   (make-instance 'output-pane
     :background :white)
   :separator
   (make-instance 'output-pane
     :background :blue))
 :y-ratios '(1 nil 4 nil 1)
 :title "You can drag the divider, but not the separator"
 :background :gray))
```

Dividers and separators can also be placed between panes in a row-layout or even combinations of row and column layouts.

### 6.6.4 Static layout

static-layout is a layout that simply places each of its children where the geometry specifies \((x, y, \text{visible-min-width} \text{ and } \text{visible-min-height})\). The children can be moved and resized by \((\text{setf static-layout-child-position})\) and \((\text{setf static-layout-child-size})\).

An important subclass of static-layout is pinboard-layout, which is documented in “Creating graphical objects” on page 187. pinboard-layout is used to create your own kind of panes.

### 6.6.5 Interface toolbars

Your interface can have a toolbar which the user can configure by selecting and rearranging the buttons to display. To implement this, specify an interface toolbar as described in Chapter 9, “Adding Toolbars”.
6.6.6 Docking layout

docking-layout allows docking/undocking of panes, which means interactively moving the panes between places in the interface (docking) and into standalone floating windows (undocking). The full functionality is available only on Microsoft Windows, while GTK+ gives very limited functionality. On Cocoa it is completely static. Docking layouts are especially useful for toolbars, but can contain other panes.

To allow moving a pane between different places in the interface, you need to group several docking-layouts. This done by using make-docking-layout-controller to create a controller object, and then passing the controller when making the docking-layout with the initarg :controller. You then place each docking-layout in a different place in the interface, by including it in the layout hierarchy of the interface in the usual way, and then it is possible to interactively move panes between all the docking-layouts that share the controller.

If you merely want to allow undocking, you do not need a controller.

The function docking-layout-pane-docked-p can be used to test whether a pane is docked in a specific docking-layout, and can be used with cl:setf to programmatically dock a pane in a specific docking-layout or to undock it (to do this, dock it to nil).

The function docking-layout-pane-visible-p can be used to test whether a pane is docked in one of the docking-layouts in the group of a docking-layout (that is, layouts with the same controller) or is undocked, and the docking-layout or the floating window is visible. It can be used with cl:setf to change the visibility of the docking-layout (if the pane is docked) or the floating window (undocked).

There is an example in:

(example-edit-file "capi/layouts/docking-layout")

6.6.7 Multiple-Document Interface (MDI)

In LispWorks for Windows, the CAPI supports MDI through the class document-frame. MDI is not supported on other platforms.
To use MDI in the CAPI, define an interface class that inherits from `document-frame`, and use the two special slots `capi:container` and `capi:windows-menu` as described below.

In your interface’s layouts, use the symbol `capi:container` in the `description` to denote the pane inside the MDI interface in which child interfaces are added.

`document-frame-container` is a reader which returns the `document-container` of the `document-frame`.

Interfaces of any type other than subclasses of `document-frame` may be added as children. To add a child interface in your MDI interface, call `display` on the child interface and pass the MDI interface as the `screen` argument. This will display the child interface inside the container pane. To obtain a list of the child interfaces, call the `screen` reader function `screen-interfaces`, passing the frame’s `document-container` as the `screen` argument.

You can use most of the normal CAPI window operations such as `top-level-interface-geometry` and `activate-pane` on windows displayed as children of a `document-frame`.

The slot `capi:windows-menu` contains the Windows Menu, which allows the user to manipulate child interfaces. The standard functionality of the Windows Menu is handled by the system and normally you will not need to modify it. However, you will want to specify its position in the menu bar. Do this by adding the symbol `capi:windows-menu` in the `:menu-bar` option of your `define-interface` form.

By default the menu bar is made by effectively appending the menu bar of the `document-frame` interface with the menu bar of the current child. You can customize this behavior with `merge-menu-bars`.

### 6.6.7.1 MDI example

This example uses `document-frame` to create a primitive `cl:apropos` browser.

Firstly we define an interface that lists symbols. There is nothing special about this in itself.
Laying Out CAPI Panes

(capi:define-interface symbols-listing ()
  ((symbols :initarg :symbols))
  (:panes
    (symbols-pane capi:list-panel
      :items symbols
      :print-function
      'symbol-name))
  (:default-initargs
    :best-width '(character 40)
    :best-height '(character 10)))

Next we define the MDI interface. Note:

1. It inherits from document-frame.
2. capi:container is used in the layout description.
3. capi:windows-menu is in the :menu-bar list.
4. When the interface showing the symbols is being displayed, the MDI interface is passed as the screen argument to display.

Otherwise, this example uses standard Common Lisp and CAPI functionality.
6.7 Changing layouts and panes within a layout

To browse apropos of a specific string

(capi:display (make-instance 'my-apropos-browser :string "EDITOR")

6.7 Changing layouts and panes within a layout

To change to another layout, use (setf pane-layout):
Laying Out CAPI Panes

(setf layout
  (capi:contain 'row-layout
    (make-instance 'title-pane :text "One")
    (make-instance 'title-pane :text "Two")
    :visible-min-height 100)))

(apply-in-pane-process
  layout #'(setf pane-layout)
  (make-instance 'column-layout
    :description
    (list (make-instance 'title-pane :text "Three")
          (make-instance 'title-pane :text "Four")))
  (element-interface layout))

To change the panes within a layout, use (setf layout-description):

(setf layout
  (capi:contain 'row-layout
    (make-instance 'title-pane :text "One")
    (make-instance 'title-pane :text "Two")
    :visible-min-height 100)))

(apply-in-pane-process
  layout #'(setf layout-description)
  (list (make-instance 'title-pane :text "Three")
         (make-instance 'title-pane :text "Four")
         (make-instance 'title-pane :text "Five")
         layout))

Note: A CAPI layout must not reuse panes that are already displayed in another layout.
An interface or its children can be altered programmatically in many ways. This chapter describes APIs for the most common of these.

**Note:** By default, each CAPI interface runs in its process. It is important to understand that an on-screen interface and its elements must be accessed only in the process of that interface. In most circumstances the user alters the interface by a callback inside the interface, which will automatically happen in the correct process. However, calls from other processes (including other CAPI interfaces) should use `execute-with-interface`, `execute-with-interface-if-alive`, `apply-in-pane-process` or `apply-in-pane-process-if-alive`.

### 7.1 Initialization

If necessary you can run code just before or just after your interface’s windows are displayed on screen.

You can do this by defining a `:before` or `:after` method on the generic function `interface-display`. Your method will run just before or just after your interface is displayed on screen. For example:
(defun make-text (self createdp)
  (multiple-value-bind (s m h dd mm yy)
      (decode-universal-time (get-universal-time))
    (format nil "Window ~S ~:~2,'0D:~2,'0D:~2,'0D"
      "created~" :displayed~" self createdp h m s))}

(capi:define-interface dd () () (:panes (dp capi:display-pane)))

(defmethod capi:interface-display :before ((self dd))
  (with-slots (dp) self
    (setf (capi:display-pane-text dp)
      (make-text self t))))

(capi:contain (make-instance 'dd))

Sometimes initialization code can be put in the create-callback of your interface, though adding it in suitable methods for initialize-instance or interface-display is usually better.

### 7.2 Resizing and positioning

Programmatic resizing can be done using the function set-top-level-interface-geometry. For example, to double the width of an interface about its center:

```
(setf interface (contain (make-instance 'interface)))
```

Use the mouse or window manager-specific gesture to resize the interface, then evaluate:

```
(multiple-value-bind (x y w h)
    (top-level-interface-geometry interface)
  (execute-with-interface interface
    'set-top-level-interface-geometry
    interface
    :x (round (- x (* 0.5 w)))
    :y y
    :width (* 2 w)
    :height h))
```

All resize operations are subject to the constraints. The constraints can be altered programmatically as described in “Changing the constraints” on page 87.
Resize operations are also subject to automatic modification by the system in cases where the new window geometry coincides with a system area such as the Mac OS X menu bar or the Microsoft Windows taskbar, as described in “Positioning CAPI windows” on page 99.

### 7.2.1 Positioning CAPI windows

You should not assume that a window is located where it has just been programmatically positioned. Instead you should query the current position by `top-level-interface-geometry`.

So if you wish to display CAPI interface windows $W_1$ and $W_2$ relative to each other. You should:

1. Display $W_1$ (by `display`), then
2. Query position of $W_1$, then
3. Arrange for $W_2$ to have the desired relative position, for example in its `make-instance` or later by `set-hint-table`, then
4. Display $W_2$.

The reason for this is that the window system may disallow certain positions (for example on the Mac OS X menu bar) therefore you cannot be certain of the position of $W_1$.

### 7.3 Geometric queries

The visible size of a pane can be found by `simple-pane-visible-height` and `simple-pane-visible-width`, or `simple-pane-visible-size` (which returns two values, `width` and `height`). Other geometric values can be accessed using `with-geometry`. See “Width and height hints” on page 80 for the meaning of visible, external and internal size.

The function `convert-relative-position` can be used to convert coordinates between one pane or screen to another pane or screen.

Inside a static-layout (including pinboard-layout) the function `static-layout-child-position` and `static-layout-child-size` can be used to find (and set) the coordinates of a child.
7 Programming with CAPI Windows

Setting coordinates of panes (other than inside a \texttt{static-layout}) is done by the layout mechanism which is described in Chapter 6, “Laying Out CAPI Panes”. In most cases, you use geometric hints or set the scroll parameters, as described in “Specifying geometry hints” on page 79.

7.4 Scrolling

7.4.1 Programmatic scrolling

Programmatic scrolling is implemented with the generic function \texttt{scroll}. This example shows vertical scrolling in a \texttt{list-panel}:

\begin{verbatim}
(setf list-panel
  (contain
    (make-instance 'list-panel
      :items (loop for i below 100 collect i)
      :vertical-scroll t)))

  (apply-in-pane-process
   list-panel 'scroll list-panel :vertical :move 50)
\end{verbatim}

Chapter 10, “Defining Interface Classes - top level windows” shows how an \texttt{editor-pane} can be scrolled using editor commands.

An \texttt{output-pane} can be made to scroll - see “output-pane scrolling” on page 199.

You can also use the functions \texttt{set-horizontal-scroll-parameters} and \texttt{set-vertical-scroll-parameters} to affect scrolling operations.

The current scroll position can be found by using \texttt{get-scroll-position}. Using it later in a call to \texttt{scroll} with \texttt{:move} scrolls the pane back to the same position.

7.4.2 Scroll values and initialization keywords

The six \texttt{:scroll-* simple-pane} initargs for each dimension correspond to the six keyword arguments of \texttt{set-horizontal-scroll-parameters}/\texttt{get-}
horizontal-scroll-parameters and set-vertical-scroll-parameters/get-vertical-scroll-parameters as follows:

Table 7.1 Specifying scroll parameters: the correspondence between simple-pane initargs and keyword arguments

<table>
<thead>
<tr>
<th>simple-pane initargs</th>
<th>keyword argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>:scroll-horizontal-slug-size</td>
<td>:slug-size</td>
</tr>
<tr>
<td>:scroll-vertical-slug-size</td>
<td></td>
</tr>
<tr>
<td>:scroll-start-x</td>
<td>:min-range</td>
</tr>
<tr>
<td>:scroll-start-y</td>
<td></td>
</tr>
<tr>
<td>:scroll-width</td>
<td>:max-range</td>
</tr>
<tr>
<td>:scroll-height</td>
<td></td>
</tr>
<tr>
<td>:scroll-initial-x</td>
<td>:slug-position</td>
</tr>
<tr>
<td>:scroll-initial-y</td>
<td></td>
</tr>
<tr>
<td>:scroll-horizontal-step-size</td>
<td>:step-size</td>
</tr>
<tr>
<td>:scroll-vertical-step-size</td>
<td></td>
</tr>
<tr>
<td>:scroll-horizontal-page-size</td>
<td>:page-size</td>
</tr>
<tr>
<td>:scroll-vertical-page-size</td>
<td></td>
</tr>
</tbody>
</table>

The values for all of these parameters should be real numbers. The set of values supplied for each dimension is treated independently from the other set.

The difference between the max-range and min-range specifies the range of scrolling. When applied to the scrollbar display, all the values are scaled by the ratio between the height/width of the scrollbar and the range, for example

\[
\text{slug-size-in-pixels} = \frac{\text{slug-size} \times \text{scrollbar-height-in-pixels}}{(\text{max-range} - \text{min-range})}
\]

The slug-position is also translated by the min-range:

\[
\text{slug-position-in-pixels} = \frac{(\text{slug-position} - \text{min-range}) \times \text{scrollbar-height-in-pixels}}{(\text{max-range} - \text{min-range})}
\]

The scrolling position of the pane is the slug-position (translated by the min-range) scaled by the ratio between the pane dimension (width or height) and the slug-size, that is:
\[ \text{pane-scrolling-position} = (\text{slug-position} - \text{min-range}) \times \frac{\text{pane-dimension}}{\text{slug-size}} \]

When \text{slug-size} is not supplied or is \text{nil}, it is set to track the dimension of the pane, so the scaling factor above is 1, and all the other numbers can be considered as if specified in pixels in the internal coordinates of the pane. If \text{slug-size} is supplied, it is in effect creating a scaling factor between the values and the coordinates in the pane.

The \text{min-range} initial value defaults to 0, the \text{max-range} initial value defaults to either the width/height in pixels of the data in the pane if this is deducible, otherwise to the height of the pane. The latter is not useful, and typically the \text{max-range} is the one value that you have to specify. In many cases it is the only value you need to specify.

The initial \text{slug-position} defaults to 0.

The \text{step-size} defines the amount to scroll for a gesture that means step (typically clicking on the arrows at the ends of the scrollbar). It initially defaults to the dimension of a character in the pane in pixels. Note that this is normally useful only if \text{slug-size} is not set, otherwise it is scaled by \text{pane-dimension} / \text{slug-size}. If you set the \text{slug-size}, you probably want to set the \text{step-size} too.

\text{page-size} defines the amount to scroll for page gestures (typically clicking on the scroll bar outside the scroll slug). It initially defaults to \text{slug-size} - \text{step-size}, which is normally the useful value.

### 7.4.3 Automatic scrolling

Automatic scrolling of the parent to show the focus pane can be specified by using \text{scroll-if-not-visible-p}.

For \text{output-pane} with "internal" scrolling (see “output-pane scrolling” on page 199), you can force some area to become visible, that is scroll as needed, by using \text{ensure-area-visible}.

### 7.5 Updating pane contents

Use only the documented functions such as the accessors (\text{setf editor-pane-text}) and (\text{setf collection-items}) and so on to set the data in a
7.5 Updating pane contents

For details, see the manual pages for the particular pane class and its superclasses in Chapter 21, “CAPI Reference Entries”.

7.5.1 Updating windows in real time

If your code needs to cause visible updates while continuing to do further computation, then you should run your computation in a separate thread which is not directly associated with the CAPI window.

Consider the following example where real work is represented by calls to \texttt{sleep}:

1. Evaluate this code:

\begin{verbatim}
(defun change-text (win text)
  (setf (title-pane-text win) text))

(defun my-callback (win)
  (change-text win "Go")
  (loop
    for i from 0 to 20 do
    (change-text win (format nil "~D" i))
    (sleep 0.1)))

(defun test ()
  (let* ((p1 (make-instance 'title-pane :text "init"))
          (p2 (make-instance 'button :text "Go"
                           :callback-type :none
                           :callback #'(lambda ()
                                         (lambda ()
                                           (my-callback p1))))))
    (contain (make-instance 'row-layout :description (list p1 nil p2))
             :width 200 :height 200)))
\end{verbatim}

2. Run \texttt{(test)} and note that the updates do not appear until \texttt{my-callback} returns. This is because it uses only one thread.

3. Now try this modified callback which uses a worker thread to perform the calculations:
(defun my-work-function ()
  (let ((mbox (mp:ensure-process-mailbox)))
    ;; This should really have an error handler.
    (loop (let ((event (mp:process-read-event mbox
                        "Waiting for events")))
      (cond ((consp event)
        (apply (car event) (cdr event)))
        ((functionp event)
        (funcall event))))))

(setf *worker*
  (mp:process-run-function "Worker process" ()
    'my-work-function))

(defun change-text (win text)
  (apply-in-pane-process win
    #'(setf title-pane-text)
    text win))

(defun my-callback (win)
  (mp:process-send
    *worker*
    #'(lambda ()
      (change-text win "Go")
      (loop
        for i from 0 to 20 do
        (change-text win (format nil "~D" i))
        (sleep 0.1))))))

4. Run (test) again: you should see the updates appear immediately.

A real application might also display an Abort button during the computation,
with a callback that aborts the worker process.

Also see this example:

(example-edit-file "capi/elements/progress-bar-from-background-thread")

### 7.6 Edit actions on the active element

It is possible to perform standard edit actions like copy and paste on the cur-
rent active element, which is not necessarily a CAPI pane, using the functions
active-pane-edit-function, for example active-pane-copy.
These functions find the active element and try to perform the operation on it. The active element can potentially not correspond to a CAPI pane, for example when prompting for a file the active element is somewhere in the dialog, which is a standard dialog of the windowing system rather than being a CAPI interface.

It is also possible to define what edit operations do when they are called on a pane in an interface class which you have defined, by specializing the `pane-interface-*` methods such as `pane-interface-copy-object`. For choices, there is also `item-pane-interface-copy-object`. Typically these methods will need to access the system clipboard, using `set-clipboard` and `clipboard` (see “Clipboard” on page 265).

### 7.7 Manipulating top-level windows

#### 7.7.1 Visibility and focus

To bring a top level window to the front (on top of other windows) call `raise-interface`, and to put it behind other windows call `lower-interface`.

To hide a window call `hide-interface`, and to unhide it call `show-interface`.

To raise an interface and give the input focus to a pane inside it, call `activate-pane`. For more information about the input focus, see “Focus” on page 14.

You can test whether the interface in which a pane is contained is visible by calling `interface-visible-p`.

#### 7.7.2 Iconifying and restoring windows

You can iconify an interface window as follows:

```
(setf (top-level-interface-display-state interface) :iconic)
```

You can also make it be hidden, maximized or restore it to normal, and you have the option to create it in one of these states initially. For the details see `top-level-interface-display-state`.
You can test whether an interface is iconified by calling \texttt{interface-iconified-p}.

### 7.7.3 Closing windows

To close a CAPI interface window unconditionally, call the generic function \texttt{destroy}.

To close a CAPI interface window such that its \texttt{confirm-destroy-function} is called first to allow the user to confirm, call \texttt{quit-interface}. You must call it in the window’s process, for example in the callback of a menu item.

### 7.7.4 Finding interfaces

You can use the function \texttt{locate-interface} to find an interface of a specified class which is currently displayed. It uses the method \texttt{interface-match-p} to decide if there is any "matching" interface, in which case that is simply returned, otherwise it uses \texttt{interface-reuse-p} to decide if any instance of the class can be reused, in which case it reinitializes it using \texttt{reinitialize-interface} and returns it.

\texttt{find-interface} uses \texttt{locate-interface} to find an interface, and if succeeds it activates it, otherwise it creates a new interface. \texttt{find-interface} is used by the LispWorks IDE when starting the tools.

You can call \texttt{collect-interfaces} to obtain a list of displayed interfaces of a specific class.

It is possible to switch off locating of interfaces by calling \texttt{(setf reuse-interfaces-p)}. This causes \texttt{locate-interface} to always return \texttt{nil}, and hence \texttt{find-interface} will always create new interface. \textbf{Note:} The IDE uses a different switch for its own interfaces, which can be set from the Preferences... dialog.

### 7.7.5 Quitting applications

To make an application quit when one of its CAPI windows is closed, make that window’s \texttt{destroy-function} call \texttt{quit}.

To arrange for a delivered CAPI application to quit automatically when all of its CAPI windows are closed, call \texttt{deliver} with \texttt{:quit-when-no-windows t}. 
7.7.6 Preserving information when saving an IDE session

You can save a session in the LispWorks IDE, either programmatically by \texttt{hcl:save-current-session} or interactively from the \texttt{Tools} menu. If you integrate your own interfaces with the LispWorks IDE and want associated information to be preserved over session saving, you can define \texttt{interface-preserve-state} methods on your own interfaces. You can also use \texttt{interface-preserving-state-p} in the \texttt{destroy-callback} and \texttt{interface-display} methods to check for any destroying/displaying that is performed as part of session saving (as opposed to the normal \texttt{display/destroy} cycle).
7 Programming with CAPI Windows
Creating Menus

You can create menus for an application using the menu class. For more control you can also use menu-component and menu-item.

menu, menu-component and menu-item all inherit from the callbacks class, which defines callbacks that are called when the user selects an item in the menu. They also inherit from the menu-object class, which adds some menu-specific callback functionality, title and enabling.

You should make sure you have defined the test-callback and hello functions before attempting any of the examples in this chapter. Their definitions are repeated here for convenience.

(defun test-callback (data interface)
  (display-message "Data ~S in interface ~S"
                   data interface))

(defun hello (data interface)
  (declare (ignore data interface))
  (display-message "Hello World"))

The menus in the menu bar of a window are defined by the :menu-bar of the interface. See define-interface, the interface initarg :menu-bar-items, and Section 10.3.1. The macro define-interface allows you to define menus by specifying the arguments that you would pass to cl:make-instance if
you made them explicitly. The actual menus in the menu bar have the properties described in this chapter.

8.1 Creating a menu

A menu can be created in much the same way as any of the CAPI classes you have already met.

1. Enter the following into a Listener:

```lisp
(setq menu
  (make-instance 'menu
    :title "Foo"
    :items ('"One" "Two" "Three" "Four")
    :callback 'test-callback))

(setq interface
  (make-instance 'interface
    :menu-bar-items (list menu)))

(display interface)
```

This creates a CAPI interface with a menu, *Foo*, which contains four items. Choosing any of these items displays its arguments. Each item has the callback specified by the `:callback` keyword.

A submenu can be created simply by specifying a menu as one of the items of the top-level menu.

2. Enter the following into a Listener:

```lisp
(setq submenu
  (make-instance 'menu
    :title "Bar"
    :items ('"One" "Two" "Three" "Four")
    :callback 'test-callback))

(setq menu
  (make-instance 'menu
    :title "Baz"
    :items (list 1 2 submenu 4 5)
    :callback 'test-callback))

(contain menu)
```

This creates an interface which has a menu, called *Baz*, which itself contains five items. The third item is another menu, *Bar*, which contains four items. Once again, selecting any item returns its arguments.
Menus can be nested as deeply as required using this method.

**Note:** In general you must not use a CAPI menu object in multiple different places in menu bar(s) at the same time. This is because menu bar menus are created when the interface is displayed, and (like any other CAPI pane) cannot be used elsewhere at the same time. Supply distinct instances instead. The one exception is popup menus, which are actually created only when they are on the screen, so they can be used repeatedly and in different places.

### 8.2 Presenting menus

The most common way of presenting menus is in the menu bar. This is done by putting the menus in the menu bar of an interface, typically by using `:menu-bar in define-interface`. It is also possible to set the menu bar dynamically using `(setf interface-menu-bar-items)`.

On Cocoa, you may want to define the application menu, the menus that are shown when no interface is active, and maybe a Dock context menu. For these, you will need to define your own subclass of `cocoa-default-application-interface`, and use `set-application-interface` on an instance of this class. See entry for `cocoa-default-application-interface`.

Pane-specific menus are invoked automatically by the system for the appropriate user gesture. See “Popup menus for panes” on page 122 for a full discussion of the mechanism that finds the menu to raise.

There is also a special pane `popup-menu-button`, which raises a menu when clicked.

In addition, you can raise a menu programmatically by calling `display-popup-menu`.

### 8.3 Grouping menu items together

The `menu-component` class lets you group related items together in a menu. This allows similar menu items to share properties, such as callbacks, and to be visually separated from other items in the menus. Menu components are actually choices.
Here is a simple example of a menu component. This creates a menu called `Items`, which has four items. `Menu 1` and `Menu 2` are ordinary menu items, but `Item 1` and `Item 2` are created from a menu component, and are therefore grouped together in the menu.

```
(setq component (make-instance 'menu-component :items '("item 1" "item 2") :print-function 'string-capitalize :callback 'test-callback))

(contain (make-instance 'menu :title "Items" :items (list "menu 1" component "menu 2") :print-function 'string-capitalize :callback 'hello) :width 150 :height 0)
```

Figure 8.1 A menu

Menu components allow you to specify, via the `:interaction` keyword, selectable menu items — either as multiple-selection or single-selection items. This is like having radio buttons or check boxes as items in a menu, and is a popular technique among many GUI applications.

The following example shows you how to include a panel of radio buttons in a menu.
8.3 Grouping menu items together

```lisp
(setq radio (make-instance 'menu-component
    :interaction :single-selection
    :items '("This" "That")
    :callback 'hello))

(setq commands (make-instance 'menu
    :title "Commands"
    :items
    (list "Command 1" radio "Command 2")
    :callback 'test-callback))

(contain commands)
```

Figure 8.2 Radio buttons included in a menu

The menu items **This** and **That** are radio buttons, only one of which may be selected at a time. The other menu items are just ordinary commands, as you saw in the previous examples. Note that the CAPI automatically groups the items which are parts of a menu component so that they are separated from other items in the menu.

This example also illustrates the use of more than one callback in a menu, which of course is the usual case when you are developing real applications. Choosing either of the radio buttons displays one message on the screen, and choosing either **Command1** or **Command2** returns the arguments of the callback.

Checked menu items can be created by specifying :multiple-selection to the :interaction keyword, as illustrated below.
8 Creating Menus

(setq letters (make-instance 'menu-component
  :interaction :multiple-selection
  :items (list "Alpha" "Beta")))

(contain (make-instance 'menu
  :title "Greek"
  :items (list letters)
  :callback 'test-callback))

Figure 8.3 An example of checked menu items

Note how the items in the menu component inherit the callback given to the parent, eliminating the need to specify a separate callback for each item or component in the menu.

Within a menu or component, you can specify alternatives for a main menu item that are invoked by modifier keys. See “Alternative menu items” on page 119 for more information.

8.4 Creating individual menu items

The menu-item class lets you create individual menu items. These items can be passed to menu-components or menus via the :items keyword. Using this class, you can assign different callbacks to different menu items.

(setq test (make-instance 'menu-item
  :title "Test"
  :callback 'test-callback))

(setq hello (make-instance 'menu-item
  :title "Hello"
  :callback 'hello))

(setq group (make-instance 'menu-component
  :items (list test hello)))
8.5 The CAPI menu hierarchy

Remember that each instance of a menu item must not be used in more than one place at a time.

8.5 The CAPI menu hierarchy

The combination of menu items, menu components and menus can create a hierarchical structure as shown schematically in Figure 8.5 and graphically in Figure 8.6. This menu has five elements, one of which is itself a menu (with three menu items) and the remainder are menu components and menu items. Items in a menu inherit values from their parent, allowing similar elements to share relevant properties whenever possible.
(defun menu-item-name (data)
  (format nil "Menu Item ~D" data))

(defun submenu-item-name (data)
  (format nil "Submenu Item ~D" data))

(contain
  (make-instance 'menu
    :items (list
      (make-instance 'menu-component
        :items '(1 2)
        :print-function 'menu-item-name)
      (make-instance 'menu-component
        :items (list 3
          (make-instance 'menu
            :title "Submenu"
            :items '(1 2 3)
            :print-function 'submenu-item-name)
          :print-function 'menu-item-name))
      (make-instance 'menu-item
        :data 42))
    :print-function 'menu-item-name))

Figure 8.5 A schematic example of a menu hierarchy
8.6 Mnemonics in menus

On Microsoft Windows and GTK+ you can control the mnemonics in menu titles and menu items using the initargs `:mnemonic, :mnemonic-title` (and if necessary `:mnemonic-escape`).

This example illustrates the various ways you can specify the mnemonics in a menu:
This example shows two ways to specify menu title mnemonics within the :menus option of a define-interface form. The first way, using :mnemonic, is the most natural:

```
(capi:define-interface menu-bar-mnemonics ()
 ()
 (:panes (panel capi:text-input-pane
          :visible-min-width 200))
 (:layouts (main-layout
capi:column-layout '(panel))))
 (:menus
 (menu1 "Menu One"
  ("Foo")
  :mnemonic #\O)
 (menu2 nil
  ("Bar")
  :mnemonic-title "Menu &Two")
 (:menu-bar menu1 menu2))

(capi:display (make-instance 'menu-bar-mnemonics))
```
8.7 Accelerators in menus

To define an accelerator key for a menu command, supply the initarg accelerator to the menu-item. See menu-item for the details.

8.7.1 Standard default accelerators

On Microsoft Windows and GTK+, by default a standard accelerator is added to a menu item if its title matches a standard menu command. The standard accelerators are:

- Edit > Copy Ctrl+C
- Edit > Cut Ctrl+X
- Edit > Find... Ctrl+F
- Edit > Paste Ctrl+V
- Edit > Redo Ctrl+Y
- Edit > Replace... Ctrl+H
- Edit > Select All Ctrl+A
- Edit > Undo Ctrl+Z
- File > Close Ctrl+W
- File > Exit Ctrl+Q
- File > New Ctrl+N
- File > Open... Ctrl+O
- File > Print... Ctrl+P
- File > Save Ctrl+S
- Works > Refresh F5

8.8 Alternative menu items

Menus can include "alternative" items, which are invoked if some modifiers are held while selecting the "main" item. The modifiers are defined by the :accelerator initarg of the item, which also allows the item to be invoked by
a keyboard accelerator key if specified. On Cocoa, the title and accelerator of
the alternative item appear when the appropriate modifier(s) are pressed.

A menu item becomes an alternative to an immediately previous item when it
is made with initarg :alternative t. Each alternative item must have the
same parent as its previous item. That is, they are within the same menu and
menu component, as described in “Grouping menu items together” on page
111. More than one alternative item can be supplied for a given main item by
putting them consecutively in the menu. The main item is the item preceding
the first alternative item.

The main item and its alternative items forms a group of items. The
accelerators of all items in the group must consist of the same key, but with
different modifiers. If there is no need for an accelerator key, the main item
should not have an accelerator and the alternative items should have
accelerators with Null as the key, for example "Shift-Null".

When the menu is displayed, only one item from the group will be shown. On
Windows, GTK+ and Motif the main item is always displayed. Cocoa displays
the item with the least number of modifiers initially, so to get a consistent
cross-platform behavior, the main item should have the least number of modi-
fiers. On Cocoa, pressing modifier keys that match alternative items changes
the title and accelerators displayed for the item.

When the user selects an item with the modifiers pressed, the appropriate
alternative item is selected.

To make a menu-item an alternative item, pass the initarg :alternative t
and a suitable value for the initarg :accelerator.

There is an example illustrating alternative menu items in

(example-edit-file "capi/elements/accelerators")

Note: Accelerators of alternative items do not work on Motif.

8.9 Disabling menu items

A function can be specified via the :enabled-function initarg (inherited
from menu-object), that determines whether or not the menu, menu item, or
menu component is enabled. By default, a menu object is always enabled.
Consider the following example:

```lisp
(defvar *on* nil)
(contain
 (make-instance 'menu
   :items
   (list
    (make-instance 'menu-item
      :title "Foo"
      :enabled-function #'(lambda (menu) *on*))
    (make-instance 'menu-item
      :title "Bar"))))
```

Figure 8.7 A menu with a disabled menu item

Changing the value of *on* between t and nil in the Listener, using setq, results in the menu item changing between the enabled and disabled states.

### 8.9.1 Dialogs and disabled menu items

By default, items in the menu bar menus and sub-menus are disabled while a dialog is on the screen on top of the active window. You can override this by passing a suitable value for the `menu-item` initarg :enabled-function-for-dialog.

### 8.10 Menus with images

You can add images to menu items. Supply the :image-function initarg when creating the menu, as illustrated in

```lisp
(example-edit-file "capi/elements/menu-with-images")
```
Note: on some platforms support for images in menus is limited to menu items without text and/or images without transparency. If `pane-supports-menus-with-images` returns true, then images are fully supported in menus.

### 8.11 The Edit menu on Cocoa

LispWorks now adds a minimal `Edit` menu to all CAPI interfaces when running in the LispWorks IDE, which makes the edit gestures `Command+V`, `Command+C` and `Command+X` work in every interface displayed in the LispWorks IDE.

However, to implement these gestures in your CAPI/Cocoa runtime application, you must include an `Edit` menu explicitly in your interface definition, as described in “Adding menus” on page 144.

To remove the automatic menu when running your program in the LispWorks IDE, pass the initarg `:auto-menus nil` when making the interface.

Note that, in the presence of an application interface (see `cocoa-default-application-interface`), a CAPI interface with no menus of its own and with `:auto-menus nil` uses the menu bar from the application interface.

### 8.12 Popup menus for panes

The CAPI tries to display a popup menu for a pane when the `:post-menu` gesture is entered by the user (mouse-right-click or `Shift+F10` on Microsoft Windows, GTK+ or Motif, control-click on Cocoa). See below for the special case of `output-pane`.

It first tries to get a menu for the pane. There are two mechanisms by which it can get a menu: which is tried depends on the value of `pane-menu`.

1. If the pane’s initarg `pane-menu` is not `:default` in the call to `make-instance`, then its value is used. If the value is a function or a fbound symbol, it is called with four arguments: the pane, data (this is the selected object if there is a selection), x, y. It should return a menu. If it is not a function or a fbound symbol, it should be a menu, which is used directly. The `:pane-menu` mechanism is useful when the menu needs to
be dependent on the location of the mouse inside the pane, or when each pane requires a unique menu. In other cases, the other mechanism is more useful.

2. If pane-menu is :default (this is the default value), CAPI calls the generic function make-pane-popup-menu with two arguments: the pane and its interface. The result should be a menu.

If the chosen mechanism does not produce a menu, the CAPI does not do anything in response to :post-menu.

The system definition of make-pane-popup-menu calls pane-popup-menu-items with the pane and the interface, and if this returns a non-nil list, it calls make-menu-for-pane to make the menu. You can define make-pane-popup-menu methods that specialize on your pane or interface classes, but in most cases it is more useful to add methods to pane-popup-menu-items. make-menu-for-pane is used to generate the menu, and it makes the menu such that by default all setup callbacks are done on the pane itself, rather than on the interface. make-pane-popup-menu is useful when the application needs a menu with the same items as the items on the popup menu, typically to add it to the menu bar.

In output-pane, you control the input behavior using the input-model. By default, the system assigns :post-menu and :keyboard-post-menu (Shift+F10) to a callback that raises a menu as described above, but your code can override this in the input-model.

Note: Accelerators are ignored in a pane-menu.

### 8.13 Displaying menus programmatically

You can programmatically display a menu by using display-popup-menu (which is used internally to raise the context menu). The menu that display-popup-menu displays can be any properly constructed menu object, for example:
(defun popup-animal-menu (animal interface)
  (let* ((items (list (string-append
                       "Get a picture of a " animal)
                      (string-append
                       "Send a postcard to " animal)
                      (menu (make-instance 'capi:menu :items items)))
       (menu (make-instance 'capi:display-popup-menu menu :owner interface)))

  (capi:contain (make-instance 'capi:list-panel
                           :items
                           '("zebra" "dog" "parrot")
                           :selection-callback
                           'popup-animal-menu))

Click on an item to see the menu.
You can use popup-menu-force-popdown to force a popup menu down (that
is, make it disappear). This is useful for writing scripts that emulate user in-
teractions.

### 8.14 The Application menu

The CAPI includes an interface to the Application menu supporting standard
Mac OS X behaviors in your delivered LispWorks applications.
See these examples:

```lisp
(example-edit-file "capi/applications/cocoa-application")
(example-edit-file "delivery/macos/simple-application")
(example-edit-file "delivery/macos/full-application")
```

and the manual entries in the reference section, starting with cocoa-default-
application-interface.
Adding Toolbars

You can add a toolbar for an interface using the `interface initarg :toolbar-items`. This creates a toolbar which is automatically positioned correctly in the window, which the user can customize, and which has platform-standard behavior such as folding on Cocoa. Such a toolbar is referred to as an `interface toolbar`.

You can also create toolbars using the `toolbar` class explicitly, and arrange them using layouts in the same way as other elements. This approach is used to implement buttons on a `text-input-pane` as seen in various tools in the LispWorks IDE such as the Class Browser, but you should note that it has some disadvantages. For more information see “Non-standard toolbars” on page 134.

Toolbar buttons typically have images. The examples in this chapter use three standard image identifiers. To run the example code that follows, first evaluate this form:

```lisp
(setq file-images (list :std-file-new
                        :std-file-open
                        :std-file-save))
```

You also should define these callback functions before attempting any of the examples in this chapter:
(defun test-callback (data interface)
  (display-message "Data ~S in interface ~S"
      data interface))

(defun print-callback (data interface)
  (declare (ignore data interface))
  (display-message "Print Something"))

(defun hello (data interface)
  (declare (ignore data interface))
  (display-message "Hello World"))

9.1 Creating a toolbar button

To create a toolbar button you can do:

(setf print-button
  (make-instance 'toolbar-button
    :image :std-print
    :text "Print Something"
    :name :print-something))

You should supply image, text and name. This is because the user can customize the toolbar such that one (or all) of these appear, as described in “Modifying toolbars” on page 131.

A toolbar-button cannot be displayed directly. To include it in an interface toolbar, do:

(display
  (make-instance 'interface
    :toolbar-items (list print-button)))

9.2 Creating a toolbar with several buttons

Let us create three more buttons:
9.2 Creating a toolbar with several buttons

(setf file-buttons
    (loop for image in file-images
          collect
          (make-instance 'toolbar-button
                          :image image
                          :name image
                          :text
                          (string-capitalize
                           (substitute #\Space #\-
                           (string image)))))))

and then include them along with the print button defined in “Creating a toolbar button” on page 126:

(display
    (make-instance
      'interface
      :toolbar-items (append file-buttons (list print-button))))

Remember that each instance of a toolbar button must not be used in more than one place at a time.

It is possible to include toolbar buttons which are not initially displayed, but which are available for the user to add. For the details, see “Modifying toolbars” on page 131.

9.2.1 Grouping toolbar buttons

The toolbar-component class lets you group related buttons together in a toolbar. This allows similar buttons to:

- Share properties such as callbacks.
- Be visually separated from other buttons in the toolbar.
- On Microsoft Windows, form a separately dockable group of items.

Toolbar components are actually choices similar to button panels. By default, their interaction is :single-selection.

We can amend our example using toolbar components to group the file buttons separately from the print button:
9.2.2 Implicitly-created buttons

A toolbar-component may contain arbitrary Lisp objects as items. For each such object, a toolbar button is automatically created, using the appropriate elements of the component’s images, names, texts and tooltips lists.

```lisp
(display
(make-instance 'interface
  :toolbar-items (list
                  (make-instance 'toolbar-component
                    :items file-buttons)
                  (make-instance 'toolbar-component
                    :items (list print-button)))
              :visible-min-width 200))
)
```

Rather than selection-callback above, you could supply callbacks to specify callback functions for each button.

9.3 Specifying the image for a toolbar button

There are several ways to supply the image for a toolbar button, including direct specification of an image object. The simplest approach is to use a symbol which is registered as an image identifier, including the pre-registered standard images, as in the preceding examples. For details of this and the other way to supply images, see toolbar-button.
You can, if desired, supply an alternative image which is displayed while the button is selected in a :multiple-selection component (see “Advanced toolbar features” on page 133), using the initarg selected-image.

### 9.3.1 Specifying images for a group of toolbar buttons

In a toolbar-component it is possible to specify images for the buttons by supplying an image-set as the default-image-set, along with integers in the images initarg specifying the index for the image of each button:

```lisp
(display
 (make-instance
  'interface
 :toolbar-items
 (list
   (make-instance
    'toolbar-component
    :items '(1 2) :names '(1 2) :texts '("One" "Two")
    :images '(0 1)
    :default-image-set
    (make-general-image-set
     :image-count 5
     :id
     (gp:read-external-image
      (example-file
       "capi/elements/images/toolbar-radio-images.bmp")
     :transparent-color-index 7))))))
```

### 9.4 Specifying toolbar callbacks

Supply the selection-callback initarg to specify a callback for a toolbar button:

```lisp
(setf print-button
 (make-instance 'toolbar-button
  :image :std-print
  :text "Print File"
  :selection-callback 'print-callback))
```

You can also supply selection-callback for a toolbar-component. This specifies the same callback function for each button in the component.

To specify different callback functions for each button in a toolbar-component, either make the buttons explicitly as above, or supply the callbacks initarg.
9.4.1 Sharing toolbar callbacks with menu items

Where you want a toolbar button to perform the same command as a menu item, use the :remapped initarg.

`remapped` should match (by cl:equalp) the name of the `menu-item`:

```lisp
(display (make-instance 'interface :menu-bar-items (list (make-instance 'menu :items (list (make-instance 'menu-item :name 'say-hello :data "Hello" :callback 'test-callback)))) :toolbar-items (list (make-instance 'toolbar-button :image :std-file-new :remapped 'say-hello))))
```

9.4.2 Other types of callback for a toolbar button

You can, if desired, supply a `retract-callback` which is called when the button is deselected in a :multiple-selection component. You can also make a button display a dropdown menu nearby. See “Advanced toolbar features” on page 133 for the details.

9.5 Specifying tooltips for toolbar buttons

There are two ways to implement tooltips in an interface toolbar:

- Group the buttons in a `toolbar-component` and supply the :tooltips initarg. `tooltips` should be a list containing a string for each button in the component. For an example of this see

  `(example-edit-file "capi/applications/simple-symbol-browser")`
9.6 Modifying toolbars

An interface toolbar can be customized by the user. It can also be manipulated programmatically.

9.6.1 User-customization of toolbars

The user can change toolbar state, that is the set of visible toolbar items, their order and their appearance. The user does this via the context menu on the toolbar. This menu includes commands to display the button images or titles...
(or both), and a **Customize Toolbar...** command to alter the set of items, including separators and spaces, and the order in which the items appear.

Figure 9.1 The toolbar context menu

To raise the customization dialog programmatically, call `interface-customize-toolbar`.

You can supply a default toolbar state in the initarg `default-toolbar-states`. This is used when the user presses the **Default** button in the **Customize Toolbar** dialog. You can read this value with `interface-default-toolbar-states`.

You can control the initial toolbar state by supplying the initarg `toolbar-states`.

**9.6.2 Changing an interface toolbar programmatically**

You can read and change the `toolbar-states` slot programmatically. Its value should be a `toolbar-state plist`.

Be aware that `toolbar-states` may not be the same each time you read it, because the user may have changed it as described in “User-customization of toolbars” on page 131.

For the details, see the accessor `interface-toolbar-state`. 
9.7 Advanced toolbar features

9.7.1 Toolbar items other than buttons with images

A toolbar-component, a toolbar or the interface toolbar may also contain CAPI panes as items, which will appear within the toolbar. This is typically used with text-input-pane, option-pane, and text-input-choice. Each pane should have toolbar-title (see simple-pane) specified, to provide the text that is shown for the toolbar item:

```
(display
 (make-instance
  'interface
  :toolbar-items (list
    (make-instance 'toolbar-component
      :items (list print-button))
    (make-instance 'text-input-pane
      :text "Text Input Pane"
      :visible-min-width :text-width
      :toolbar-title "Text Input Pane")
    (make-instance 'text-input-choice
      :items
      (list "Text Input Choice1"
        "Text Input Choice2"
        :visible-min-width :text-width
      :toolbar-title "Text Input Choice")
    (make-instance 'option-pane
      :items
      (list "Option Panel"
        "Option Pane2"
        :visible-min-width :text-width
      :toolbar-title "Option Pane")
    )
  :visible-min-width 500))
)
```

Note: Some platforms may not recommend placing text input panes and so on in a toolbar. You may wish to consult the appropriate user interface guidelines before adding such a toolbar in your application.

Note: Each toolbar-button or simple-pane in the toolbar-items list (including those within a toolbar-component) should have a name that is not cl:eql to any other item in the list. These names are needed to support :items in interface-toolbar-state and the :toolbar-states initarg.
Toolbar buttons can display text, which should be in the *data* or *text* slot inherited from *item*. You can specify whether text and/or image is displayed, using `:display` in the *toolbar-states* initarg or *interface-toolbar-state*.

### 9.7.2 Alternative interaction in a toolbar

You can make a `toolbar-component` with `interaction :multiple-selection` and then each of its buttons may have a `retract-callback` which is called when the user clicks a selected button to deselect it.

### 9.7.3 Toolbar buttons with menus

You can add a menu to a toolbar button, which is displayed via a separate smaller button next to the main button. To do this, supply `dropdown-menu` or `dropdown-menu-function`. See `toolbar-button` for the details.

### 9.8 Disabling toolbar items

To disable a toolbar button you can set its `enabled` slot to `nil`. Alternatively supply it with a suitable `enabled-function`. For more information about this, see `toolbar-object`.

You can disable and enable a `toolbar-component` in the same way.

### 9.9 Non-standard toolbars

You can create toolbars using the `toolbar` class explicitly, and arrange them like other elements, using layouts. This approach differs from `interface toolbars` as described in the preceding sections of this chapter. Note that, while it allows you some flexibility this approach can produce non-standard appearance, does not support user-customization, and does not support folding on Cocoa. Other than this, non-standard toolbars support all the features described in the preceding sections of this chapter, and additionally:

- You can disable and enable a `toolbar` using its `enabled` or `enabled-function` slot.
- There are two further options for a button with a dropdown menu.
It can be merged with the separate smaller button such that it displays only the menu and does not respond to its `selection-callback`.

Alternatively, it can display the menu only after being pressed down for a while, and respond to the `selection-callback` when pressed only briefly. In this case the smaller button does not appear.

See `toolbar-button` for the details.

- You can make a toolbar button which displays an `interface` (and does not respond to its `selection-callback`) by supplying `popup-interface`.

There is an example here:

```lisp
(example-edit-file "capi/elements/toolbar")
```

### 9.9.1 Changing a non-standard toolbar dynamically

The best way to change a non-standard toolbar is to use a `switchable-layout`. Include a `toolbar` instance in each of two or more child layouts, of which only one is visible at a time.

There is an example here:

```lisp
(example-edit-file "capi/layouts/switchable")
```
9 Adding Toolbars
Defining Interface Classes - top level windows

Interface classes (subclasses of interface) are (mainly) used to define top level windows and the components inside them. Normally, each kind of a window in an application is specified by a different interface class. Complex dialogs are also typically presented using an interface class.

An interface class can also be used to create a component made of several elements. This is especially useful when these elements need to interact, because the syntax of define-interface makes it easier to refer to elements in the interface. To distinguish between this usage and the more typical case where an interface instance corresponds to a window, the latter case is referred to as a "top level interface" (also "top level window"). The parent of a top level interface is a screen (or document-container inside MDI on Microsoft Windows) rather than another pane.

An interface class is defined by the macro define-interface (normally, cl:defclass inheriting from an interface class works too). define-interface is an extension of cl:defclass with additional options for specifying display elements. After an interface class is defined it can be used to display a window or a dialog by calling display or display-dialog on an instance of it. For example:
(capi:define-interface my-interface ()
  ()
  (:panes (my-display-pane capi:display-pane :text "Some text"))
  (:default-initargs :title "My title"))
(capi:display (make-instance 'my-interface))

10.1 The define-interface macro

The macro define-interface is used to define subclasses of interface, the superclass of all CAPI interface classes.

It is an extension to defclass, which provides the functionality of that macro as well as the specification of the panes, layouts, and menus from which an interface is composed. It takes the same arguments as defclass, and supports the additional options :panes, :layouts, :menus, and :menu-bar.

If you specify :panes but no :layouts, then on creating your interface the CAPI will create a column-layout and arrange the panes in it in the order they are defined. For real applications you will need some control over how the panes are laid out, and this is supplied via the :layouts option.

Each component of the interface is named in the code, and a slot of that name is added to the class created. When an instance of the class is made, each component is created automatically and placed in its slot.

To access a pane, layout or menu in an instance of your interface class you can define an accessor, like the viewer pane in “Adapting the example” on page 141, or simply use with-slots.

When defining a component, you can use other components within the definition simply by giving its name. You can refer to the interface itself by the special name capi:interface.

There are examples using define-interface in:

(example-edit-file "capi/applications/pong")
(example-edit-file "capi/applications/othello")
10.2 An example interface

Here is a simple example of interface definition done with `define-interface`:

```scheme
(define-interface demo ()
  ()
  (:panes
   (page-up push-button :text "Page Up")
   (page-down push-button :text "Page Down")
   (open-file push-button :text "Open File"))
  (:layouts
   (row-of-buttons row-layout '(page-up page-down open-file)))
  (:default-initargs :title "Demo"))
```

An instance of this interface can be displayed as follows:

```scheme
(display (make-instance 'demo))
```

At the moment the buttons do nothing, but they will eventually do the following:

- **Open File** will bring up a file prompter and allow you to select a filename from a directory. Later on, we will add an editor pane to display the chosen file’s contents.
- **Page Down** will scroll downwards so that you can view the lower parts of the file that cannot be seen initially.
- **Page Up** will scroll upwards so that you can return to parts of the file seen before.

Figure 10.1 A demonstration of a CAPI interface
Later on, we will specify callbacks for these buttons to provide this functionality.

The (:default-initargs :title "Demo") part at the end is necessary to give the interface a title. If no title is given, the default name is “Untitled CAPI Interface”.

### 10.2.1 How the example works

Examine the define-interface form to see how this interface was built. The first part of this form is shown below:

```
(define-interface demo () ()
```

This part of the macro is identical to defclass — you provide:

- The name of the interface class being defined.
- The superclasses of the interface (defaulting to interface).
- The slot descriptions.

The interesting part of the define-interface form occurs after these def-class-like preliminaries, where it lists the elements that define the interface’s appearance. Here is the :panes part of the definition:

```
(:panes
 (page-up push-button :text "Page Up")
 (page-down push-button :text "Page Down")
 (open-file push-button :text "Open File"))
```

Two arguments — the name and the class — are required to produce a pane. You can supply slot values as you would for any CLOS object.

The :panes list specifies panes that are made when the interface is made. However it does not specify which panes are displayed: that is controlled dynamically by the interface’s layout which may contain all, some or none of the panes in the :panes list. The interface may also display other panes that are made explicitly, though this is less common.

Here is the :layouts part of the definition:
10.3 Adapting the example

Three arguments — the name, the class, and any child layouts — are required to produce a layout. Notice how the children of the layout are specified by using their component names.

The interface information supplied in this section is a series of specifications for panes and layouts. It could also specify menus and a menu bar. In this case, three buttons are defined. The layout chosen is a row layout, which displays the buttons side by side at the top of the pane.

10.3 Adapting the example

The :panes and :layouts keywords can take a number of panes and layouts, each specified one after the other. By listing several panes, menus, and so on, complicated interfaces can be constructed quickly.

To see how simply this is done, let us add an editor pane to our interface. We need this to display the text contained in the file chosen with the Open File button.

The editor pane needs a layout. It could be added to the row-layout already built, or another layout could be made for it. Then, the two layouts would have to be put inside a third to contain them (see Chapter 6, Laying Out CAPI Panes).

The first thing to do is add the editor pane to the panes description. The old panes description read:

```lisp
(:panes
 (page-up push-button :text "Page Up")
 (page-down push-button :text "Page Down")
 (open-file push-button :text "Open File"))
```

The new one includes an editor pane named viewer.
(:panes
  (page-up push-button :text "Page Up")
  (page-down push-button :text "Page Down")
  (open-file push-button :text "Open File")
  (viewer editor-pane
   :title "File:
   :text "No file selected."
   :visible-min-height '(:character 8)
   :reader viewer-pane))

This specifies the editor pane, with a stipulation that it must be at least 8 characters high. This allows you to see a worthwhile amount of the file being viewed in the pane.

Note the use of :reader, which defines a reader method for the interface which returns the editor pane. Similarly, you can also specify writers or accessors. If you omit accessor methods, it is still possible to access panes and other elements in an interface instance using with-slots.

The interface also needs a layout containing the editor pane along with the buttons. The old layouts description read:

```
(:layouts
  (row-of-buttons row-layout
   '(page-up page-down open-file)))
```

The new one reads:

```
(:layouts
  (main-layout column-layout
   '(row-of-buttons viewer))
  (row-of-buttons row-layout
   '(page-up page-down open-file))
)
```

This encapsulates the new pane viewer into a column-layout called main-layout. This is used as the default layout, specified by setting the :layout initarg to main-layout in the :default-initargs section. If there is no default layout specified, uses the first one listed.
By putting the layout of buttons and the editor pane in a column layout, their relative position has been controlled: the buttons appear in a row above the editor pane.

The code for the new interface is now as follows:

```lisp
(define-interface demo () ()
 (:panes
  (page-up push-button :text "Page Up")
  (page-down push-button :text "Page Down")
  (open-file push-button :text "Open File")
  (viewer editor-pane :title "File:" :text "No file selected." :visible-min-height '(:character 8) :reader viewer-pane))
(:layouts
  (main-layout column-layout '(row-of-buttons viewer))
  (row-of-buttons row-layout '(page-up page-down open-file)))
  (:default-initargs :title "Demo"))
```

Displaying an instance of the interface by entering the line of code below produces the window in Figure 10.2:
10.3.1 Adding menus

To add menus to your interface you must first specify the menus themselves, and then a menu bar of which they will be a part.

Let us add some menus that duplicate the proposed functionality for the buttons. We will add:

- A File menu with a Open option, to do the same thing as Open File.
- A Page menu with Page Up and Page Down options, to do the same things as the buttons with those names.

The extra code needed in the define-interface call is this:

{(display (make-instance 'demo))

Figure 10.2 A CAPI interface with editor pane

<table>
<thead>
<tr>
<th>Menu</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>File</td>
<td>Open</td>
</tr>
<tr>
<td>Page</td>
<td>Page Up, Page Down</td>
</tr>
</tbody>
</table>

{(::menus
 (file-menu "File"
 (*Open*))
 (page-menu "Page"
 (*Page Up* "Page Down")))
 (:menu-bar file-menu page-menu)
Menu definitions give a slot name for the menu, followed by the title of the menu, a list of menu item descriptions, and then, optionally, a list of keyword arguments for the menu.

In this instance the menu item descriptions are just strings naming each item, but you may wish to supply initialization arguments for an item — in which case you would enclose the name and those arguments in a list.

The menu bar definition simply names all the menus that will be on the bar, in the order that they will appear. By default, of course, the environment may add menus of its own to an interface — for example the Window menu in the LispWorks IDE.

The code for the new interface is:
(define-interface demo ()
  ()
  (:panes
   (page-up push-button :text "Page Up")
   (page-down push-button :text "Page Down")
   (open-file push-button :text "Open File")
   (viewer editor-pane :title "File:"
                        :text "No file selected."
                        :visible-min-height '(:character 8)
                        :reader viewer-pane))
  (:layouts
   (main-layout column-layout '(row-of-buttons viewer))
   (row-of-buttons row-layout '(page-up page-down open-file)))
  (:menus
   (file-menu "File"
             (*Open*))
   (page-menu "Page"
             (*Page Up" "Page Down")))
  (:menu-bar file-menu page-menu)
  (:default-initargs :title "Demo"))
Figure 10.3  A CAPI interface with menu items

The menus contain the items specified — try it out to be sure.

10.4 Connecting an interface to an application

Having defined an interface in this way, you can connect it up to your program using callbacks, as described in earlier chapters. Here we define some functions to perform the operations we required for the buttons and menus, and then hook them up to the buttons and menus as callbacks.

The functions to perform the page scrolling operations are given below:

```lisp
(defun scroll-up (data interface)
  (call-editor (viewer-pane interface)
    "Scroll Window Up")
)

(defun scroll-down (data interface)
  (call-editor (viewer-pane interface)
    "Scroll Window Down")
)
```

The functions use the generic function `call-editor` which calls an editor command (given as a string) on an instance of an `editor-pane`. The editor
commands **Scroll Window Up** and **Scroll Window Down** perform the necessary operations for **Page Up** and **Page Down** respectively.

The function to perform the file-opening operation is given below:

```lisp
(defun file-choice (data interface)
  (let ((file (prompt-for-file "Select a File:")))
    (when file
      (setf (titled-object-title (viewer-pane interface))
            (format nil "File: ~S" file))
      (setf (editor-pane-text (viewer-pane interface))
            (file-string file))))
```

This function prompts for a filename and then displays the file in the editor pane.

The function first produces a file prompter through which a file may be selected. Then, the selected file name is shown in the title of the editor pane (using `titled-object-title`). Finally, the file name is used to get the contents of the file and display them in the editor pane (using `editor-pane-text`).

The correct callback information for the buttons is specified as shown below:

```lisp
(:panes
 (page-up push-button :text "Page Up" :selection-callback 'scroll-up)
 (page-down push-button :text "Page Down" :selection-callback 'scroll-down)
 (open-file push-button :text "Open File" :selection-callback 'file-choice)
 (viewer editor-pane :title "File:"
                        :text "No file selected." :visible-min-height '(:character 8) :reader viewer-pane))
```

All the buttons and menu items operate on the editor pane `viewer`. A reader is set up to allow access to it.

The correct callback information for the menus is specified as shown below:
In this case, each item in the menu has a different callback. The complete code for the interface is listed below — try it out.

(capi:define-interface demo ()
 ()
 (:panes
  (page-up capi:push-button
    :text "Page Up"
    :selection-callback 'scroll-up)
  (page-down capi:push-button
    :text "Page Down"
    :selection-callback 'scroll-down)
  (open-file capi:push-button
    :text "Open File"
    :selection-callback 'file-choice)
  (viewer capi:editor-pane
    :title "File:"
    :text "No file selected."
    :visible-min-height '(:character 8)
    :reader viewer-pane))
 (:layouts
  (main-layout capi:column-layout
    '((row-of-buttons viewer))
  (row-of-buttons capi:row-layout
    '((page-up page-down open-file))))
 (:menus
  (file-menu "File"
    ("Open")
    :selection-callback 'file-choice)
  (page-menu "Page"
    ("Page Up"
      :selection-callback 'scroll-up)
    ("Page Down"
      :selection-callback 'scroll-down)))
 (:menu-bar file-menu page-menu)
 (:default-initargs :title "Demo")
)
10.5 Controlling the appearance of the top level window

This section describes ways to control the appearance and behavior of the top level window displaying our CAPI interface.

10.5.1 Window styles

The `interface initarg window-styles` allows you to control a wide range of visible properties of the top level window including borders, shadows and so on. `window-styles` also allows you to specify that the window can be moved by dragging on its background, or cannot be minimized, or acts as a windoid, or is visible only when the application is the current application, and so on.

Many of these properties are specific to the windowing system and are therefore not supported on all platforms. See `interface` for the details.

10.5.2 Controlling the interface title

A top level interface has a title, which normally appears at the top. This title is used by the Window Browser tool in the LispWorks IDE and also by system tools that deal with windows. The title is set either by the `interface initarg :title` or the accessor `interface-title`.

In addition, you can specify a prefix and/or suffix that is added to the titles of all the interfaces in an application, by using `set-default-interface-prefix-suffix`.

The title string is constructed by the generic function `interface-extend-title`. The default method constructs it from the title of the interface and the prefix/suffix, if any. For finer control, you can define `interface-extend-title` method(s) for specific interface class(es).

When you change something that may cause the title to change, that is some value that `interface-extend-title` uses, you can use one of `update-interface-title`, `update-screen-interface-titles` or `update-all-interface-titles` to cause the titles to be recomputed.
10.5.3 Indicating a changed document

Some windowing systems support a visible indication that a displayed document has been edited, helping users to see that it needs saving. To implement this in a CAPI interface, set `interface-document-modified-p` at suitable times.

You can extend the definition of the viewer pane in our example like this:

```lisp
(viewer capi:editor-pane
 :title "File:"
 :text "No file selected."
 :visible-min-height '(:character 8)
 :reader viewer-pane
 :change-callback 'check-viewer-modified)
```

and define the `change-callback` as follows:

```lisp
(defun check-viewer-modified (viewer point old-length new-length)
  (declare (ignore point old-length new-length))
  (setf (capi:interface-document-modified-p
         (capi:element-interface viewer))
        (editor:buffer-modified
         (capi:editor-pane-buffer viewer))))
```

Note: Currently `interface-document-modified-p` has an effect only on Cocoa.

10.6 Querying and modifying interface geometry

The functions `screen-monitor-geometries`, `screen-internal-geometries` and `pane-screen-internal-geometry` support the notions of monitor geometry (which includes "system" areas such as the Mac OS X menu bar and the Microsoft Windows task bar) and internal geometry (which excludes the system areas).

Note that code which relies on the position of a window should not assume that a window is located where it has just been programmatically displayed, but should query the current position by `top-level-interface-geometry`. This is because the geometry includes system areas where CAPI windows cannot be displayed.
10.6.1 Support for multiple monitors

CAPI supports multiple monitors by providing functions such as `screen-internal-geometries` to query "screen rectangles" representing the area of each monitor. The function `virtual-screen-geometry` returns a rectangle just enclosing all the screen rectangles.

There is a "primary monitor" which displays any system areas. The origin of the coordinate system (as returned by `top-level-interface-geometry` and `screen-internal-geometry`) is the topmost/leftmost visible pixel of the primary monitor. Thus (0,0) may be in a system area such as the Mac OS X menu bar.

Note also that CAPI does not currently support multiple desktops, which are called workspaces in Linux distros, and called Spaces on Mac OS X.

10.6.2 Saving and restoring top-level geometry

You can specify that the geometry of a top level interface should be saved when the interface is closed and be used to define the geometry of the interface when it is opened again (potentially in a different invocation of the application). You need to define a method of `top-level-interface-save-geometry-p` that returns true for the interface class. You normally also need to specify where to save the geometry, using `top-level-interface-geometry-key`.
Dialogs: Prompting for Input

A dialog is a window that is displayed transiently to interact with the user. While a dialog is on screen it is placed in front of other windows and user input is directed to it. Dialogs are used for interactions that are relatively rare, and so do not deserve a permanent place on the screen, and for alerting the user about something that they need to be aware of. For example, when an application needs to know where to save a file, it typically prompts with a file dialog. If there is a problem during saving the file, it would normally alert the user by some other dialog.

Dialogs can also be cancelled, meaning that the application should cancel the current operation. In order to let you know whether or not the dialog was cancelled, CAPI dialog functions always return two values. The first value is the return value itself, and the second value is `nil` if the dialog returned normally and `true` if the dialog was cancelled.

On Cocoa you can control whether a CAPI dialog is application-modal or window-modal. In the latter case the user can interact with the application’s other windows while the dialog is on screen.

The CAPI provides both a large set of predefined dialogs and the means to create your own. This chapter takes you through some example uses of the predefined dialogs, and then shows you how to create custom built dialogs.
The last section briefly describes a way to get input for completions via a special non-modal window.

### 11.1 Some simple dialogs

The simplest form of dialog is a message dialog, which is used to inform the user of some event, typically the end of a long operation.

```
(display-message "Hello world")
```

Figure 11.1 A message dialog

When you want to ensure that the messages dialog is associated with (that is, owned by) a specific pane, you can use `display-message-for-pane`. There is also `prompt-with-message`, which can be used for displaying the message in a window-modal sheet on Cocoa.

```
(display-message
  "This function is ~S"
  'display-message)
```

Figure 11.2 A second message dialog
Another simple dialog asks the user a question and returns \texttt{t} or \texttt{nil} depending on whether the user has chosen yes or no. This function is \texttt{confirm-yes-or-no}.

\begin{verbatim}
(confirm-yes-or-no
 "Do you own a pet?"
)
\end{verbatim}

Figure 11.3 A message dialog prompting for confirmation

For more control over such a dialog, use the function \texttt{prompt-for-confirmation}.

\section*{11.2 Prompting for values}

The CAPI provides a number of different dialogs for accepting values from the user, ranging from accepting strings to accepting whole Lisp forms to be evaluated.

\subsection*{11.2.1 Prompting for strings}

The simplest of the CAPI prompting dialogs is \texttt{prompt-for-string} which returns the string you enter into the dialog.
11 Dialogs: Prompting for Input

(prompt-for-string
 "Enter a string:" )

Figure 11.4 A dialog prompting for a string

An initial value can be placed in the dialog by specifying the keyword argument :initial-value.

11.2.2 Prompting for numbers

The CAPI also provides a number of more specific dialogs that allow you to enter other types of data. For example, to enter an integer, use the function prompt-for-integer. Only integers are accepted as valid input for this function.

(prompt-for-integer
 "Enter an integer:" )

There are a number of extra options which allow you to specify more strictly which integers are acceptable. Firstly, there are two arguments :min and :max which specify the minimum and maximum acceptable integers.

(prompt-for-integer
 "Enter an integer in the inclusive range [10,20]:" 
 :min 10 :max 20 )

If this does not provide enough flexibility you can specify a function that validates the result with the keyword argument :ok-check. This function is passed the current value and must return non-nil if it is a valid result.
11.2 Prompting for values

(prompt-for-integer
 "Enter an odd integer:" :ok-check 'oddp)

Try also the function prompt-for-number.

11.2.3 Prompting for an item in a list

If you would like the user to select an item from a list of items, the function prompt-with-list should handle the majority of cases. The simplest form just passes a list to the function and expects a single item to be returned.

(prompt-with-list '(:red :yellow :blue) "Select a color:")

Figure 11.5 A dialog prompting for a selection from a list
You can also specify the interaction style that you would like for your dialog, which can be any of the interactions accepted by a choice. The specification of the interaction style to this choice is made using the keyword argument :interaction:

```
(prompt-with-list
  '(:red :yellow :blue)
  "Select a color:"
  :interaction :multiple-selection)
```

By default, the dialog is created using a list-panel to display the items, but the keyword argument :choice-class can be specified with any choice pane. Thus, for instance, you can present a list of buttons.

```
(prompt-with-list
  '(:red :yellow :blue)
  "Select a color:"
  :interaction :multiple-selection
  :choice-class 'button-panel)
```

![Figure 11.6 Selection from a button panel](image)

Finally, as with any of the prompting functions, you can specify additional arguments to the pane that has been created in the dialog. Thus to create a column of buttons instead of the default row, use:
11.2 Prompting for values

(prompt-with-list
 '(:red :yellow :blue)
 "Select a color:" 
:interaction :multiple-selection
 :choice-class 'button-panel
 :pane-args
 '(:layout-class column-layout))

Figure 11.7 Selection from a column of buttons

There is a more complex example in

(example-edit-file "capi/choice/prompt-with-buttons")

11.2.4 Prompting for files

To prompt for a file, use the function prompt-for-file:

(prompt-for-file
 "Enter a file:" )

You can also specify a starting pathname:
11 Dialogs: Prompting for Input

(prompt-for-file
 "Enter a filename:"
 :pathname (sys:get-folder-path :documents))

Figure 11.8 Selection of a file

Try also the function `prompt-for-directory`.

11.2.5 Prompting for fonts
To obtain a `gp:font` object from the user call `prompt-for-font`.

11.2.6 Prompting for colors
To obtain a color specification from the user call `prompt-for-color`.
11.2.7 Prompting for Lisp objects

The CAPI provides a number of dialogs specifically designed for creating Lisp aware applications. The simplest is the function \texttt{prompt-for-form} which accepts an arbitrary Lisp form and optionally evaluates it.

\begin{verbatim}
(promise-for-form
 "Enter a form to evaluate:"
 :evaluate t)

(promise-for-form
 "Enter a form (not evaluated):"
 :evaluate nil)
\end{verbatim}

Another useful function is \texttt{prompt-for-symbol} which prompts the user for an existing symbol. The simplest usage accepts any symbol, as follows:

\begin{verbatim}
(prompt-for-symbol
 "Enter a symbol:")
\end{verbatim}

If you have a list of symbols from which to choose, then you can pass \texttt{prompt-for-symbol} this list with the keyword argument \texttt{:symbols}.

Finally, using \texttt{:ok-check} you can accept only certain symbols. For example, to only accept a symbol which names a class, use:

\begin{verbatim}
(prompt-for-symbol
 "Enter a class-name symbol:"
 :ok-check #'(lambda (symbol)
              (find-class symbol nil)))
\end{verbatim}

Cocoa programmers will notice that the dialog sheet displayed by this form prevents input to other LispWorks windows while it is displayed. For information about creating dialog sheets which are not application-modal, see “Window-modal Cocoa dialogs” on page 161.

11.3 Window-modal Cocoa dialogs

By default, CAPI dialogs on Cocoa use sheets which are application-modal. This means that the application does not allow the user to interact with its other windows until the sheet is dismissed.

This section describes how to create CAPI dialogs which are window-modal on Cocoa. This is done with portable code, so Windows, GTK+ and Motif pro-
grammers may wish to code their CAPI dialogs as described in this section, which would ease a future port to the Cocoa GUI.

### 11.3.1 The :continuation argument

All CAPI dialog functions take a keyword argument *continuation*. This is a function which is called with the results of the dialog.

You do not need to construct the continuation argument yourself, but rather call the dialog function inside `with-dialog-results`.

### 11.3.2 A dialog which is window-modal on Cocoa

To create a dialog which is window-modal on Cocoa, call the dialog function inside the macro `with-dialog-results` as in this example:

```lisp
(with-dialog-results (symbol okp)
  (prompt-for-symbol
   "Enter a class-name symbol:
   :ok-check #'(lambda (symbol)
                 (find-class symbol nil)))
  (when okp
    (display-message "symbol is ~S symbol" symbol)))
```

On Microsoft Windows, GTK+ and Motif this displays the dialog, calls `display-message` when the user clicks OK, and then returns. The effect is no different to what you saw in “Prompting for Lisp objects” on page 161.

On Cocoa, this creates a sheet and returns. `display-message` is called when the user clicks OK. The sheet is window-modal, unlike the sheet you saw in “Prompting for Lisp objects” on page 161.

For more details, see the manual page for `with-dialog-results`.

### 11.4 Dialog Owners

When a dialog appears, it should be “owned” by some window. The main effect of this "ownership" is that the dialog is always in front of the owner window. When either the dialog or the owner is raised, the other follows.

All CAPI functions which display a dialog allow you to specify the owner.
11.4.1 The default owner

When a dialog is displayed and the owner is not supplied or is given as nil, the CAPI tries to identify the appropriate owner. In particular, in the case where a dialog pops up in a process in which a CAPI interface is displayed, by default the CAPI uses this interface as the owner window. This case covers most situations.

11.4.2 Specifying the owner

If the default is not appropriate, then the programmer needs to supply the owner. This owner argument can be any CAPI pane that is currently displayed, and the top level interface of the pane is used as the actual owner. A CAPI pane owner must be running in the current process (see the process argument to display). Creating cross-process ownership can lead to deadlocks.

The owner can also be a screen object, which tells the system on which screen to put the dialog, but none of the windows will be the dialog's owner.

The owner can be supplied by the keyword argument :owner in functions such as display-dialog and print-dialog. Other functions such as prompt-for-string and prompt-for-file can be supplied an owner in the :popup-args list as a pair :owner owner.

11.5 Creating your own dialogs

The CAPI provides a number of built-in dialogs which should cover the majority of most programmers' needs. However, there is always the occasional need to create custom built dialogs, and the CAPI makes this very simple, using the function popup-confirmer which displays any CAPI interface as a dialog, and the functions exit-confirmer to return from such a dialog.

11.5.1 Using popup-confirmer

The function popup-confirmer is a higher level function provided to add the standard buttons to dialogs. In order to create a dialog using popup-confirmer, all you need to do is to supply a pane to be placed inside the dialog along with the buttons and the title. The function also expects a title, like all of the prompter functions described earlier.
Since interfaces and layouts are panes too, the \textit{pane} argument to \texttt{popup-confirmer} can be a layout or an interface, and often it is. Layouts are used for simple combinations of panes, and interfaces are used for complex dialogs. All the dialogs in the LispWorks IDE which are not either native, just a message or asking for a single item of input are interfaces displayed by \texttt{popup-confirmer}. As an example, you can load the Othello example file:

\begin{verbatim}
(example-edit-file "capi/applications/othello")
\end{verbatim}

which defines an interface \texttt{othello-board}, and then run it as a dialog:

\begin{verbatim}
(capi:popup-confirmer
 (make-instance 'othello-board) "Play Othello")
\end{verbatim}

Note that it works as usual, except that the menubar is not displayed.

Here is a simple example using a layout to ask the user for five strings:

\begin{verbatim}
(let* ((panes
   (loop repeat 5 collect
      (make-instance 'capi:text-input-pane)))
   (layout (make-instance 'capi:column-layout
      :description panes)))
   (multiple-value-bind (res okp)
      (capi:popup-confirmer layout "Enter some strings")
      (declare (ignore res))
      (when okp
         (loop for pane in panes collect
            (capi:text-input-pane-text pane))))
\end{verbatim}

An interface intended for display by \texttt{popup-confirmer} can also be displayed by \texttt{display} (not at the same time), in which case it is just another window. That is especially useful during development of your dialog code, because you can then work on the callbacks while the interface is displayed.
A common thing to want to do with a dialog is to get the return value from some state in the pane specified. For instance, in order to create a dialog that prompts for an integer the string entered into the `text-input-pane` would need to be converted into an integer. It is possible to do this once the dialog has returned, but `popup-confirm` has a more convenient mechanism. The function provides a keyword argument, `:value-function`, which gets passed the pane, and this function should return the value to return from the dialog. It can also indicate that the dialog cannot return by returning a second value which is non-nil.

In order to do this conversion, `popup-confirm` provides an alternative exit function to the usual `exit-dialog`. This is called `exit-confirm`, and it does all of the necessary work on exiting.

You now have enough information to write a primitive version of `prompt-for-integer`.

```lisp
(defun text-input-pane-integer (pane)
  (let* ((text
          (text-input-pane-text pane))
        (integer
          (parse-integer
           text :
           junk-allowed t)))
    (or (and (integerp integer) integer)
        (values nil t))))
```
11 Dialogs: Prompting for Input

```lisp
(popup-confirm
  (make-instance
   'text-input-pane
     :callback 'exit-confirm
     "Enter an integer:"
     :value-function 'text-input-pane-integer)

Figure 11.9 A example using popup-confirm

Note that the dialog’s OK button never becomes activated, yet pressing Return once you have entered a valid integer will return the correct value. This is because the OK button is not being dynamically updated on each keystroke in the text-input-pane so that it activates when the pane contains a valid integer. The activation of the OK button is recalculated by the function redisplay-interface, and the CAPI provides a standard callback, :redisplay-interface, which calls this as appropriate.

Thus, to have an OK button that becomes activated and deactivated dynamically, you need to specify the change-callback for the text-input-pane to be :redisplay-interface.

```lisp
(popup-confirm
  (make-instance
   'text-input-pane
     :change-callback :redisplay-interface
     :callback 'exit-confirm
     "Enter an integer:"
     :value-function 'text-input-pane-integer)

Note that the OK button now changes dynamically so that it is only ever active when the text in the text-input-pane is a valid integer.
11.5 Creating your own dialogs

Note that the Escape key activates the Cancel button - this too was set up by popup-confirmed.

The next thing that you might want to do with your integer prompter is to make it accept only certain values. For instance, you may only want to accept negative numbers. This can be specified to popup-confirmed by providing a validation function with the keyword argument :ok-check. This function receives the potential return value (the value returned by the value function) and it must return non-nil if that value is valid. Thus to accept only negative numbers we could pass minusp as the :ok-check.

```
(popup-confirmed
 make-instance
 'text-input-pane
 :change-callback :redisplay-interface
 :callback 'exit-confirmed
 "Enter an integer:"
 :value-function 'text-input-pane-integer
 :ok-check 'minusp)
```

11.5.2 Using display-dialog

popup-confirmed creates an interface (of an internal class) around the pane that you give it which displays the pane and the buttons it adds, and then calls display-dialog to actually display it. If you have an interface and do not want any of the buttons, you can call display-dialog directly.

display-dialog takes an interface (unlike popup-confirmed, which can take any pane) and displays it as a dialog. The keyword arguments can be used to control the exact behavior. You can use exit-dialog and abort-dialog to dismiss the dialog programmatically.

11.5.3 Modal and non-modal dialogs

By default popup-confirmed and display-dialog create modal dialog windows which prevent input to other application windows until they are dismissed by the user clicking on a button or another appropriate gesture. You can change this behavior by passing the modal keyword argument.
11.5.4 Getting the current dialog

The function `current-popup` can be used to find the current popup pane, if there is any, and is useful inside callbacks.

The function `current-dialog-handle` returns the "handle" of the dialog in the underlying GUI system, which may be useful in some circumstances.

11.6 In-place completion

‘In-place completion’ allows the user to select from a list of possible completions displayed in a special non-modal window which appears in front of an input pane (such as an `editor-pane` or a `text-input-pane`) but does not grab the input focus.

To raise this special window and select a completion from it, the user invokes certain keyboard gestures including Up, Down and Return. The full set of keys for operations on an in-place completion window are described “In-place completion user interface” on page 168. The user can also continue typing her input in which case the list of possible completions is updated to reflect the text in the input pane.

11.6.1 In-place completion user interface

This section describes the user interface of in-place completion.

In-place completion is available in the LispWorks IDE, in the Editor tool and also in tools that ask for a named object such as the Class Browser and the Generic Function Browser. Set the Preferences... Environment > General > Use in-place completion option to use in-place completion in the LispWorks IDE, and see LispWorks IDE User Guide for further details.

In-place completion is also available to you to use in your CAPI applications. You may wish to adapt the remainder of this section for your end-user documentation. See “Programmatic control of in-place completion” on page 172 for information on how to implement it.
11.6 In-place completion

11.6.1 Invoking in-place completion in text-input-pane and editor-pane

In a text-input-pane that supports in-place completion, any of the gestures Up, Down, PageUp, and PageDown invokes the in-place completion unless it is already displayed.

In an editor-pane, completion commands invoke in-place completion by default, though you can make them use dialogs instead by setting editor:*use-in-place-completion* to nil.

There are several Editor commands that invoke in-place completion unconditionally:

- **Abbreviated in-place Complete Symbol**
  Completes the symbol before the point, taking the string as abbreviation.

- **In-Place Complete Symbol**
  Completes the symbol before the point

- **In-Place Complete Input**
  Echo Area: Complete the input in the echo area. For file input, does file completion.

- **In-Place Expand File Name**
  Expand the file name at the current point.

- **In-Place Expand File Name with space**
  Expand the file name at the current point, allowing spaces.

See the *LispWorks Editor User Guide* for information on binding these commands to keyboard gestures. See call-editor for information on calling them from CAPI.

11.6.2 Keyboard input handling while the in-place window is displayed

Keyboard input while the in-place window is displayed goes to the input pane, but some of the input gestures are redirected to the in-place window. By default, the following gestures are redirected:

- Up, Down, PageUp, PageDown
Change the selection in the list of completions in the obvious way.

**Return**
Perform the completion using the current selected item in the list. In non-file-completion, or in file-completion when the item is not a directory, the in-place window disappears. In file-completion when the selected item is a directory, the in-place window changes to display the list of files in the completed directory.

**Escape**
Causes the in-place window to disappear, without doing anything else. Note that if the text in the input pane was edited while the in-place window was displayed, these edits are not undone.

**Control+Return**
Toggles the filter.

**Control+Shift+Return**
Toggles redirection of characters to the filter. A filter is a text-input-pane which filters the list of completions based on its contents. While the filter is on, the list of completions shows only the completions that match the filter.

While the filter is visible and enabled, all character input plus Backspace are redirected to the filter. The filter can be disabled by Control+Shift+Return, which means it still filters, but characters go to the the input pane.

The functionality of the in-place completion filter is the same as the standard filter for list-panel. For a full description of the pattern matching see "Regular expression searching" in the *LispWorks Editor User Guide*.

**Control+Shift+R, Control+Shift+E, Control+Shift+C**
Change the setting in the filter.

Other keyboard input goes to the input pane.
While the filter is off (the default), or when the filter is on and disabled, plain characters go to the input pane, and hence change the text in it. When the filter is on and is enabled, plain characters go to the filter.

11.6.1.3 Performing a completion

In a text-input-pane, performing a completion means replacing part of the text in the pane by the selected completion. In a file-completion, only the last part of the text (from the last directory separator) is replaced.

If a text-input-pane was made with complete-do-action true, once the completion was performed, if it is not file-completion and the completion is a directory, the callback of the pane is invoked.

In an editor-pane, while the in-place window is displayed, the editor highlights the part of the text that will be replaced. In non-file-completion it is the beginning of the "symbol", as seen by the editor, and the end of the "symbol". In a file-completion it is the part of the filename after the last directory separator.

Performing the completion in an editor-pane means replacing the highlighted text by the selected completion. The replacement is done as a single separate operation (for example undo will undo the replacement separately from any previous changes).

11.6.1.4 Interaction while the in-place window is displayed

Any operation that affects the text between the start of the relevant text (this is the start in a text-input-pane, and the highlighted area in an editor-pane) and the current cursor causes the in-place window to recompute the possible completions and display the new list. These operations include not only actual changes to the text, but also cursor movement.

In an editor-pane, if the insertion point moves out of the highlighted area then the in-place window goes away.

If the input pane loses the focus, the in-place window goes away, except on Motif.
11.6.2 Programmatic control of in-place completion

You can add in-place completion to your application as described in this section.

11.6.2.1 Text input panes

A text-input-pane will do in-place completion if you pass either of these initargs:

:file-completion with value t or a pathname designator, or
:in-place-completion-function with value a suitable function designator

You can add a filter to the in-place window by passing the initarg :in-place-filter. Additionally you can control the functionality for file completion by passing :directories-only and :ignore-file-suffixes. The keyword arguments :complete-do-action and :gesture-callbacks also interact with in-place completion.

The in-place completion can be invoked explicitly for a text-input-pane by calling text-input-pane-in-place-complete.

See the manual page for text-input-pane for details.

11.6.2.2 Editor panes

An editor-pane does in-place completion when your code calls the function editor:complete-in-place.

11.6.2.3 Other CAPI panes

You can also implement in-place completion on arbitrary CAPI panes by calling prompt-with-list-non-focus.
The CAPI provides a wide range of built-in panes, but it is still fairly common to need to create panes of your own. In order to do this, you need to specify both the input behavior of the pane (how it reacts to keyboard and mouse events) and its output behavior (how it displays itself). The class `output-pane` is provided for this purpose.

An `output-pane` is a fully functional graphics port. This allows it to use all of the graphics ports functionality to create graphics, and it also has a powerful input model which allows it to receive mouse and keyboard input.

`output-pane` has a subclass `pinboard-layout`, to which you can add graphic objects, which makes it easier to organize the interaction when it becomes complex. `pinboard-layout` is probably the more useful class.

### 12.1 Displaying graphics

The following is a simple example demonstrating how to create an `output-pane` and then how to draw a circle on it.
12 Creating Panes with Your Own Drawing and Input

(setq output-pane
  (contain
    (make-instance 'output-pane)
    :best-width 300
    :best-height 300))

Figure 12.1 An empty output pane

Now you can draw a circle in the empty output pane by using the graphics ports function `draw-circle`. Note that the drawing function must be called in the process of the interface containing the output pane:
12.1 Displaying graphics

```
(capi:apply-in-pane-process
  output-pane 'gp:draw-circle output-pane 100 100 50)
```

Figure 12.2 An output pane containing a circle

Notice that this circle is not permanently drawn on the output-pane, and when the window is next redisplayed it vanishes. To prove this to yourself, force the window to be redisplayed (for example by iconifying or resizing it). At this point, you can draw the circle again yourself but it will not happen automatically.

```
(capi:apply-in-pane-process
  output-pane 'gp:draw-circle output-pane 100 100 50)
```
In order to create a permanent display, you need to provide a function to the output-pane that is called to redraw sections of the pane when they are exposed. This function is called the display-callback, and it is automatically called in the correct process. When the CAPI needs to redisplay a region of an output-pane, it calls that output pane’s display-callback function, passing it the pane and the region in question.

For example, to create a pane that has a permanent circle drawn inside it, do the following:

```lisp
(defun draw-a-circle (pane x y width height)
  (gp:draw-circle pane 100 100 50))

(contain (make-instance 'output-pane :display-callback 'draw-a-circle)
          :best-width 300
          :best-height 300)
```

Notice that the callback in this example ignores the region that needs redrawing and just redraws everything. This is possible because the CAPI clips the drawing to the region that needs redisplaying, and hence only the needed part of the drawing gets done. For maximum efficiency, it would be better to only draw the minimum area necessary.

The arguments :best-width and :best-height specify the initial width and height of the interface. More detail can be found in the manual page for interface.

Now that we can create output panes with our own display functions, we can create a new class of window by using defclass as follows.

```lisp
(defclass circle-pane (output-pane)
  ()
  (:default-initargs :display-callback 'draw-a-circle))

(contain (make-instance 'circle-pane))
```
12.2 Receiving input from the user

The CAPI supports receiving input from the user through the use of an input model, which is a mapping of events to the callbacks that should be run when they occur. The input model is specified by the initarg :input-model.

When the event callback is called, it gets passed the output-pane and the x and y integer coordinates of the mouse pointer at the time of the event. A few events also pass additional information as necessary; for example, keyboard events also pass the key that was pressed.

For example, we can create a very simple drawing pane by adding a callback to draw a point whenever the left button is dragged across the pane. This is done as follows:
The input model above seems quite complicated, but it is just a list of event to callback mappings, where each one of these mappings is a list containing an event specification and a callback. An event specification is also a list containing keywords specifying the type of event required.

There is an example input model in

```
(make-instance 'output-pane
  :input-model '(((:motion :button-1) gp:draw-point))))
```

Figure 12.3 An interactive output pane
12.2 Receiving input from the user

and more examples are listed in “Output pane examples” on page 275.
For the full input-model syntax, see “Detailed description of the input model” on page 179.

12.2.1 Detailed description of the input model

The input model provides a means to get callbacks on mouse, keyboard and touch gestures in an output-pane. An input-model is a list of mappings from gesture to callback, where each mapping is a list

(gesture callback . extra-callback-args)

gesture specifies the type of gesture, which can be Gesture Spec, character, button, modifier change, key, command, cursor motion or multi-touch. These are described in the following sections. User input is processed as described in “Processing user input” on page 185.

Note: it is recommended you follow the style guidelines and conventions of the platform you are targeting when mapping gestures to callbacks.

12.2.1.1 Gesture Spec mappings

In a Gesture Spec mapping, gesture can be simply the keyword :gesture-spec, which matches any keyboard input. For specific mappings, gesture is a list

(:gesture-spec data [modifier]*)

in which data is a character object or an integer between 0 and char-code-limit (interpreted as the character object obtained by code-char), or a keyword naming a function key, and each modifier is one of the keywords :shift, :control and :meta. Note that the modifier :meta is received only when the keys style is :emacs (see interface-keys-style).

Also data can be a string which is interpreted as a Gesture Spec as if by sys:coerce-to-gesture-spec. See the LispWorks User Guide and Reference Manual for a description of this and other functions for manipulating Gesture Spec objects.
Note: on Cocoa you cannot receive Command key gestures via Gesture Spec mapping in input-model. To receive Command key gestures you should add corresponding menu items with accelerators. See menu-item for information about accelerators.

12.2.1.2 Character mappings

In a character mapping, gesture can be simply the keyword :character, which matches any character input. For specific mappings, gesture can be a list containing a single character object char, or a list

(char)

Note: where input would match both a Gesture Spec mapping and a character mapping, the Gesture Spec mapping takes precedence.

Note: in LispWorks 7.0 and later versions the cl:character type does not support the bits attribute. To represent keyboard input with modifier keys, see “Gesture Spec mappings” on page 179.

12.2.1.3 Button mappings

In a button mapping, gesture should be list

(button action [modifiers]*)

where button is one of :button-1, :button-2 or :button-3 denoting the mouse buttons. action is one of :press, :release, :second-press, :third-press, :nth-press and :motion, and each modifier is one of the keywords :shift, :control, :meta and :hyper. The :meta modifier will be the Alt key on most keyboards. On Cocoa, the :hyper modifier is interpreted as the Command key for button and motion gestures. On Windows, the :hyper modifier is currently never generated, so gesture mappings using it will never be invoked. :third-press and :nth-press are supported only on Cocoa and Motif.

Button mappings with action :nth-press are matched on the nth button click made in quick succession, but only when there is not a more specific match with :press, :second-press or :third-press. The callback for :nth-press receives an extra argument which is the count of clicks.
12.2.1.4 Modifier change mappings

In a modifier change mapping, gesture is :modifier-change, which generates a callback whenever the state of a modifier (Control, Shift and Meta key, Command on Cocoa, and Caps Lock) changes.

The callback is called with the output pane, x and y, an integer mods, followed by extra-callback-args if any. mods is calculated as a logior of sys:gesture-*-bit values. The bits that that may be set in mods are:

- sys:gesture-spec-shift-bit
- sys:gesture-spec-control-bit
- sys:gesture-spec-meta-bit
- sys:gesture-spec-hyper-bit
- sys:gesture-spec-caps-lock-bit

Note that sys:gesture-spec-hyper-bit is set when Command is pressed.

Note that for Caps Lock, the callback is generated when the state of the Caps Lock changes, not when the Caps Lock key is pressed or released.

The pane gets the callback only when it has the focus. If the pane receives the focus and the state of the modifiers is different from what it was the last time the pane had the focus, a callback is generated at that time. That means that tracking the state using the callback is reliable while the pane has the focus, but not while the pane does not have the focus.

12.2.1.5 Key mappings

Key mappings are intended for detecting low-level keyboard input. In a key mapping, gesture should be a list

\[(:key [keyname] action [modifiers]*)\]

where the optional keyname is a character naming a key (no modifiers) or one of the valid Gesture Spec keywords, action is one of :press or :release and each modifier is one of the keywords :shift, :control and :meta. The callback will receive a Gesture Spec object, with its data set to an integer ASCII code or a keyword representing the primary item on the key and its modifiers representing the set of modifiers pressed. The :meta modifier will be the Alt key on most keyboards. On Cocoa, the :hyper modifier is interpreted as the Command key for :key input.
12.2.1.6 Motion mappings

In a motion mapping, gesture can either be defined in terms of dragging a button (in which case it is defined as a button gesture with action :motion), or it can be defined for motions while no button is down by just specifying the keyword :motion with no additional arguments.

12.2.1.7 Command mappings

In a command mapping, gesture should be a command which is defined using define-command, and provides an alias for a gesture. The following commands are predefined:

- (:button-3 :press) on Motif.
- (:button-1 :press :control) on Mac OS X.
- :control-post-menu
  - (:button-3 :press :control) on Microsoft Windows, Motif and Mac OS X.
- :keyboard-post-menu
  - (:gesture-spec :f10 :shift) on Microsoft Windows, Motif and Mac OS X.

12.2.1.8 Touch mappings

On Cocoa and Windows input-model can contain mappings for multi-touch gestures from devices that can generate them (trackpad or touchscreen). These include zoom, rotate, pan, swipe (Cocoa only), two finger tap (Windows only), press and tap (Windows only), and beginning and end of sequences of gestures.

In a touch mapping gesture should be of the form:

(:touch multi-touch-keyword)

where multi-touch-keyword specifies the type of gesture as listed below. For all multi-touch gestures the callback receives as arguments the pane, and the x and y of the event. There are also an additional one or two arguments for each
specific gesture. The extra arguments are always relative to the previous state, so each event can be interpreted on each own. Use `extra-callback-args` if any are added in the end.

*multi-touch-keyword* should be one of:

- **:zoom**  The callback receives an extra argument which is the zoom factor.
- **:rotate** The callback receives an extra argument which is the angle to rotate, anti-clockwise in radians.
- **:pan**    The callback receives two extra arguments, the `delta-x` and `delta-y`, which are the amount to scroll in the x and y directions.
- **:swipe**  The callback receives an extra argument which is one of the keywords `:left`, `:right`, `:up` or `:down`.
  *:swipe* is supported only on Cocoa.
- **:two-finger-tap** The callback receives an extra argument which is the distance between the fingers.
  *:two-finger-tap* is supported only on Windows.
- **:press-and-tap** The callback receives two extra arguments, which are the `delta-x` and `delta-y` of the tapping finger from the resting finger.
  *:press-and-tap* is supported only on Windows.
- **:begin-end** The callback receives an extra argument `begin-p` which is a boolean, `t` for beginning of a sequence of events and `nil` for end. The beginning and end of sequences are determined by the underlying device implementation, which tries to identify what the user regards as a single operation.
12.2.1.9 Notes about touch mappings

Because the callbacks receive relative values, you do not need the `:begin-end` events to interpret them. These events are useful when you want to do things which correspond to user operations, for example recording a state for undo or committing a change.

They are also useful if you want to restrict the type of events that are processed inside each operation. For example, your pane may have a flag that the callbacks check and set which is used to allow only one kind of gesture to have an effect in each sequence.

The x and y coordinates are the coordinates which should be used as the center of operation. On Windows, you can track the x and y in `:zoom` and `:rotate` events, and do panning while rotating or zooming.

On Cocoa, a sequence of events (starting and ending with `:begin-end` events) can contain either `:zoom` and `:rotate` events or `:pan` events, but not a mixture of `:pan` and `:rotate` or `:zoom`. On Windows all these three types of events can be mixed in principle.

`:swipe` events (Cocoa only) are three finger brushing. `:swipe` events are always on their own, and are not enclosed in pairs of `:begin-end` callbacks.

On Cocoa, pan should generally act as a scrolling gesture, so normally you should not need to use it.

Windows touch events are described in the MSDN in

Dev Center - Desktop > Design > Guidelines > Guidelines > Interaction > Touch

Note that on Windows the Control+Mousewheel gesture generates `:zoom` events and Shift+Mousewheel generates `:rotate`.

The entries in the `input-model` look like this:

```scheme
((:touch :zoom) my-zoom-callback)
((:touch :pan) my-pan-callback)
((:touch :rotate) my-rotate-callback)
((:touch :begin-end) my-begin-end-callback)
```
12.2 Receiving input from the user

The corresponding callbacks have these signatures:

- `my-zoom-callback`\hspace{0.5cm}  `pane x y zoom-factor`
- `my-pan-callback`\hspace{0.5cm}  `pane x y delta-x delta-y`
- `my-rotate-callback`\hspace{0.5cm}  `pane x y delta-angle`
- `my-begin-end-callback`\hspace{0.5cm}  `pane x y begin-p`
- `my-swipe-callback`\hspace{0.5cm}  `pane x y direction-keyword`
- `my-two-finger-tap-callback`\hspace{0.5cm}  `pane x y distance`
- `my-press-and-tap-callback`\hspace{0.5cm}  `pane x y distance-x distance-y`

### 12.2.1.10 Processing user input

When user input matches a gesture `gesture`, the `callback` is called with the gesture callback arguments followed by any user-supplied `extra-callback-args`.

The gesture callback arguments contain three standard arguments, and for some gestures there is a fourth argument. The standard three arguments are:

- `output-pane x y`

where \((x, y)\) is the cursor position.

The following gestures have a fourth argument:

- `:gesture-spec`
- `:key`

  A gesture-spec representing the user input.

- `:character`

  A character representing the user input.

- `:modifier-change`
An integer specifying the modifiers as logior of 
\texttt{sys:gesture-spec-\textdaggerbit{\textdagger}}.

Button with \texttt{nth-press}

An integer which is the number of clicks.

\textbf{Note:} mouse gestures with \texttt{press}, \texttt{second-press}, \texttt{third-press} and \texttt{nth-press} actions can each be expected to be followed by a \texttt{release} action.

\textbf{Note:} In some circumstances \texttt{motion} events can be received even when the \texttt{output-pane} does not have the input focus. See window style \texttt{motion-events-without-focus} under interface for details.

\textit{input-model} can be set before the pane is displayed, but changes after that are ignored.

In particular, \texttt{cl:initialize-instance} is the natural place for subclasses to modify the existing \textit{input-model}, using the \texttt{output-pane} accessor \texttt{output-pane-input-model}. Note that since the mappings are processed in order, prepending to an existing \textit{input-model} overrides it when there are clashes, while appending affects only gestures for which the original \textit{input-model} did not have a match.

### 12.2.2 Commands - aliases

It is possible to define aliases for gestures (called "commands"), which is mapping between a gesture and a command (a unique Lisp object, typically a keyword). The command then can be used as the \textit{gesture} in an \textit{input-model}. That allows changing the actual user gesture to invoke the callbacks that are associated with the command in input models of many panes, without having to change the actual input model specifications.

A command is defined using \texttt{define-command}, which defines the mapping, and can also specify on which library it is applicable and a translator to change the arguments that are passed to the callback.

Commands that are defined by \texttt{define-command} can be programmatically invoked (as if the user entered the gesture) by \texttt{invoke-command} or \texttt{invoke-untranslated-command}.
12.2.3 Native input method

The input that CAPI sees may be pre-processed by a native input method. Native input methods are part of the underlying GUI system which allow the user to enter characters that do not appear on the keyboard. On GTK+ you can control whether the native input method is used by the output-pane initarg :use-native-input-method, and you can specify the default by set-default-use-native-input-method.

12.2.4 Composition of characters

Composition of characters is done by the underlying window system, which combines several keystrokes to one character (or more rarely, to several characters), and is used to input characters that are not available on the keyboard. output-pane has a callback, :composition-callback, which is called when composition starts and ends, and also if the pane is supposed to display the input, it is called to tell it what to display.

Inside the callback call for starting composition, the function set-composition-placement where relative to the composition should, which tells the system where to put any window that it popups to interact the user. For example, editor-pane uses this to set the placement at the position of the cursor.

12.3 Creating graphical objects

A common feature needed by an application is to have a number of objects displayed in a window and to make events affect the object underneath the cursor. The CAPI provides the ability to create graphical objects, to place them into a window at a specified size and position, and to display them as necessary. Also a function is provided to determine which object is under any given point so that events can be dispatched correctly.

These graphical objects are called pinboard objects, as they can only be displayed if they are contained within a pinboard-layout. Like simple panes, you display a pinboard-object by putting it in the description of a layout, but in the case of a pinboard-object the layout must be either a pinboard-layout or a layout that is a descendant of a pinboard-layout (to any depth). Adding or removing pinboard-objects can be done using the standard mechanism of the :description initarg and (setf layout-description),
but normally it should be done by `manipulate-pinboard`. This is much more efficient and causes much less flickering, which is important when there are many objects.

CAPI provides built-in pinboard object classes for several simple cases including `item-pinboard-object` for displaying text, `line-pinboard-object`, `rectangle`, `ellipse` and `arrow-pinboard-object` for simple shapes, and `image-pinboard-object` for displaying an image. To display more complex drawing, you can use `drawn-pinboard-object`, which takes a `display-callback` which actually does the drawing. For greater control, you can subclass `pinboard-object`, and define the method `draw-pinboard-object` to do the drawing, and if needed also `draw-pinboard-object-highlighted`. You can also subclass any of the specialized `pinboard-object` subclasses if it is useful.

`pinboard-object`s have geometry like `simple-pane`, that is `x`, `y`, `width` and `height`. These can be specified initially by the initargs `:x` and `:y` and geometry hints (see “Specifying geometry hints” on page 79), and can be read and set later by `static-layout-child-position` and `static-layout-child-size`. They can also be read by using the binding inside `with-geometry`, but setting should be done only by `(setf static-layout-child-position)` and `(setf static-layout-child-size)`.

For `line-pinboard-object` and its subclasses, you would normally specify the start and end points, rather than the rectangle that encloses it (which would require computations taking into account the line width and the position of any label). This is done when making the object using the initargs `:start-x`, `:start-y`, `:end-x` and `:end-y`, and later by the function `move-line`. The function `line-pinboard-object-coordinates` can be used to find the start and end points of an object.

The graphics args that are used to draw the objects in built-in subclasses of `pinboard-object` can be specified by supplying the initarg `:graphics-args`, and modified dynamically by `(setf pinboard-object-graphics-args)` and `(setf pinboard-object-graphics-arg)`. For example, the following code displays a line and after 2 seconds changes its color:
12.3 Creating graphical objects

(progn
  (setq po
    (capi:contain
      (make-instance 'capi:line-pinboard-object
        :start-x 50 :end-x 250
        :start-y 50 :end-y 50
        :graphics-args
          '(:thickness 10 :foreground :red)))))

(sleep 2)
(capi:apply-in-pane-process
  po
  #'(lambda ()
      (setf (capi:pinboard-object-graphics-arg po :foreground) :blue))))

For pinboard object classes which you define, the drawing functions that you
call need to do the drawing using the Graphics Ports drawing functions (see
“Drawing functions” on page 212). They take their coordinates with respect to
the pinboard-layout (not the object), so you need to use the x and y to com-
pute the arguments for the drawing functions. This is how the specialized
classes mentioned above know where to draw. You need to keep the drawing
inside the geometry (that is inside the rectangle defined by x, y, width and
height), because the pinboard-layout decides which objects need redrawing
using these values.

pinboard-objects can be highlighted. You need to use the functions highlight-pinboard-object and unhighlight-pinboard-object to switch the
highlight state of objects. The function pinboard-object-highlighted-p can be used to check whether an object is in the highlighted state. By default,
CAPI calls draw-pinboard-object-highlighted to add the highlight after
drawing the object. In many cases, it is better to do the highlight in the draw-
ing function (either the method of draw-pinboard-object or the display-call-
back for drawn-pinboard-object) rather than separately. Use the initarg
:no-highlight with value \texttt{t} when making the pinboard-object, and pin-
board-object-highlighted-p inside the drawing function to check whether
it needs to highlight. These examples both use this technique:

(example-edit-file "capi/graphics/circled-graph-nodes")

(example-edit-file "capi/graphics/tracking-pinboard-layout")
It is possible to set an element such that its geometry changes automatically when the pinboard-layout is resized, by using either the initarg :automatic-resize or calling set-object-automatic-resize. See:

(example-edit-file "capi/layouts/automatic-resize")

Note: pinboard-objects are implemented as graphics on a native window. Compare this with simple-pane and its subclasses, where each instance is itself a native window. A consequence of this is that simple-panes do not work well within a pinboard-layout, since they always appear above the pinboard-objects. For example, to put labels on a pinboard, use item-pinboard-object rather than display-pane or title-pane.

Note: The pinboard-layout displays the pinboard objects via its own display-callback function pinboard-layout-display. If you want do other drawing too, see the entry for pinboard-layout-display. It is also possible to draw the pinboard objects of a pinboard-layout to another graphics port (for example, a pixmap) using draw-pinboard-layout-objects.

Here is an example of the built-in pinboard object class item-pinboard-object which displays its text like a title-pane. Note that the function contain always creates a pinboard-layout as part of the wrapper for the object to be contained, and so it is possible to test the display of pinboard-objects in just the same way as you can test other classes of CAPI object.

(contain
  ;; CONTAIN makes a pinboard-layout if needed, so we don't
  ;; need one explicitly in this example.
  ;; You will need an explicit pinboard-layout if you define
  ;; your own interface class.
  (make-instance
   'item-pinboard-object
   :text "Hello world"))

Figure 12.4  A pinboard object

Here is another example illustrating item-pinboard-object:
12.3 Creating graphical objects

12.3.1 Buffered drawing

Where the display of an output-pane is complex you may see flickering on screen on some platforms. Typically this occurs in a pinboard-layout with many pinboard objects, or some other characteristic that makes the display complex.

The flickering can be avoided by passing the draw-with-buffer initarg which causes the drawing to go to an off-screen pixmap buffer. The screen is then updated from the buffer.

Note: GTK+ and Cocoa always buffer, so the draw-with-buffer initarg is ignored on these platforms.

12.3.2 Finding pinboard objects from coordinates

To find the top pinboard-object at a supplied position \((x, y)\), which is typically needed when processing user input, use pinboard-object-at-position. To decide whether a pinboard object is at a position, pinboard-object-at-position uses the generic function over-pinboard-object-p. over-pinboard-object-p has a default method that return true when the position is in the rectangle of the object, and a method for line object (subclasses of line-pinboard-object) that return true if the position is close to the line.

You add methods to over-pinboard-object-p for your own classes. For example, if your pinboard object displays a thunder picture, you may want an over-pinboard-object-p method that computes whether the position is inside the thunder drawing.

There is also the generic function pinboard-object-overlap-p, with a default method that determines whether the rectangle of the object overlaps the rectangle specified by the other arguments.

12.3.3 The implementation of graph panes

One of the major uses the CAPI itself makes of pinboard objects is to implement graph panes. The graph-pane itself is a pinboard-layout and it is built using pinboard-objects for the nodes and edges. This is because each node (and sometimes each edge) of the graph needs to react individually to the
user. For instance, when an event is received by the graph-pane, it is told which pinboard object was under the pointer at the time, and it can then use this information to change the selection.

Create the following graph-pane and notice that every node in the graph is made from an item-pinboard-object as described in the previous section and that each edge is made from a line-pinboard-object.

```lisp
(defun node-children (node)
  (when (< node 16)
    (list (* node 2)
          (1+ (* node 2)))))
```
As mentioned before, pinboard-layouts can just as easily display ordinary panes inside themselves, and so the graph-pane provides the ability to specify the class used to represent the nodes. As an example, here is a graph-pane with the nodes made from push-buttons.
124 Creating Panes with Your Own Drawing and Input

```
(make-instance 'graph-pane
  :roots '(1)
  :children-function 'node-children
  :node-pinboard-class 'push-button)
  :best-width 300 :best-height 400)
```

Figure 12.6 A graph pane with push-button nodes

12.3.4 An example pinboard object

To create your own pinboard objects, the class `drawn-pinboard-object` is provided, which is a `pinboard-object` that accepts a `display-callback` to display itself. The following example creates a new subclass of `drawn-pinboard-object` that displays an ellipse.
(defun draw-ellipse-pane (gp pane
  x y
  width height)
  (with-geometry pane
    (let ((x-radius
          (1- (floor %width% 2)))
          (y-radius
          (1- (floor %height% 2))))
          (gp:draw-ellipse
           gp
           (1+ (+ %x% x-radius))
           (1+ (+ %y% y-radius))
           x-radius y-radius
           :filled t
           :foreground
           (if (> x-radius y-radius)
               :red
               :yellow))))

(defclass ellipse-pane
  (drawn-pinboard-object)
  ()
  (:default-initargs
   :display-callback 'draw-ellipse-pane
   :visible-min-width 50
   :visible-min-height 50))

(contain
  (make-instance 'ellipse-pane
                :best-width 200
                :best-height 100)

Figure 12.7 An ellipse-pane class
The `with-geometry` macro is used to set the size and position, or geometry, of the ellipse drawn by the `draw-ellipse-pane` function. The fill color depends on the radii of the ellipse - try resizing the window to see this. For more details of see the manual page for `drawn-pinboard-object`.

Now that you have a new ellipse-pane class, you can create instances of them and place them inside layouts. For instance, the example below creates nine ellipse panes and places them in a three by three grid.
(contain
 (make-instance '
grid-layout
 :description
 (loop for i below 9
 collect
   (make-instance 'ellipse-pane)))
 :columns 3)
 :best-width 300
 :best-height 400)
12.3.5 Simple pinboard layout

simple-pinboard-layout is a subclass of pinboard-layout with only one child (a pane or a pinboard-object). It adopts the size constraints of its child.
**12.4 output-pane scrolling**

simple-pinboard-layout is useful when you want to arrange pinboard-objects using a layout pane (or a hierarchy of layouts). pinboard-objects need a pinboard-layout somewhere in the parent hierarchy, but using pinboard-layout would mean that the constraints computed by layout (top layout if it is a hierarchy) would not be automatically propagated to the next level. simple-pinboard-layout solves this problem. An example is the graph-pane, which is actually a subclass of simple-pinboard-layout, and as a child has a layout (of internal type) with a special algorithm that lays out the graph and displays it using pinboard-objects.

### 12.3.6 Tracking pinboard layout

tracking-pinboard-layout is a subclass of pinboard-layout which tracks the motion of the mouse cursor, by highlighting the object underneath it (if any). Otherwise it behaves the same as pinboard-layout. It saves you from implementing the tracking when it is desired.

(example-edit-file "capi/graphics/tracking-pinboard-layout")

### 12.4 output-pane scrolling

An output-pane or an instance of any of its subclasses can be made to scroll by passing the :vertical-scroll and/or :horizontal-scroll initargs which are inherited from simple-pane.

By default, the scrolling is what is called ordinary scrolling. In this case you just need to specify that you want scrolling by :vertical-scroll and/or :horizontal-scroll, and maybe also specify the internal scroll dimension(s) (see below).

In ordinary scrolling, all the interactions are done as if the pane has an "internal canvas" with dimensions (the "internal dimensions") which are different from the visible dimensions on the screen, and typically larger. The coordinates of input gestures and drawing in the pane are all with respect to this internal canvas. Only part of the canvas is displayed at any one time, depending on the position of the scroll slugs. The effect of scrolling is to change what part of the pane is visible, which causes a display-callback to draw any newly visible areas. However, the call to the display-callback is an ordinary call like any call (for example, like a call as result of part of the window being...
exposed), and the display-callback does not need to know anything about scrolling.

If you need to know when scrolling happened, rather than just display what is needed to display, you can use the :scroll-callback initarg to specify a callback that is called before the display-callback. However, this is not required for ordinary scrolling to work.

The internal dimensions of the pane can be specified by the initargs :scroll-height and :scroll-width, and can also be set dynamically set by set-vertical-scroll-parameters and set-horizontal-scroll-parameters. Some subclasses can compute their internal dimensions, for example graph-pane computes its internal dimensions to show all the graph, and static-layout and its subclass pinboard-layout by default compute the internal dimensions to fit their children (unless fit-size-to-children is nil).

For example, create an output-pane with vertical scroll and internal height of 600 pixels, minimum visible height of 300 pixels, and a display-callback that prints the y coordinate and the height and displays a green square at (0,100) of size 10x10 and a blue square at (0,400) of size 10x10:

```
(defun my-display-callback (pane x y width height)
  (declare (ignore x width))
  (format t " y = ~d,  height =  ~d~%" y height)
  (gp:draw-rectangle pane 0 100 10 10 :foreground :green :filled t)
  (gp:draw-rectangle pane 0 400 10 10 :foreground :blue :filled t))

(setq output-pane
  (make-instance 'capi:output-pane
    :vertical-scroll t
    :scroll-height 600
    :visible-min-height 300
    :display-callback 'my-display-callback))
```

Then display it:

```
(capi:contain output-pane)
```

When it appears on the screen its height is 300 pixels, the scrollbar is half the height. You receive a display callback with y being 0 and height 300. You see the green square 100 pixels down from the top. The blue square is invisible, because it is drawn at y = 400, which is not inside the visible area.
Now if you scroll to the bottom, you will receive a callback with \( y = 300 \) and \( \text{height} \) still 300 (possibly after several callbacks with intermediate \( y \) values). Now you see the blue square 100 pixels from the top, and the green square is invisible.

Note that the display callback knows nothing about the scrolling. It just draws. A real display callback may be made faster by avoiding the drawings which are not going to be visible, for example:

```lisp
(defun my-display-callback-1 (pane x y width height)
  (declare (ignore x width))
  (format t " y = ~d, height = ~d\% y height\n"

  (unless (or (> y 110) (< (+ Y height) 100) (> x 10))
    (gp:draw-rectangle pane 0 100 10 10
                       :foreground :green :filled t))
  (unless (or (> y 410) (< (+ Y height) 400) (> x 10))
    (gp:draw-rectangle pane 0 400 10 10
                       :foreground :blue :filled t)))
```

but this is just optimization. It does not affect what is shown on the screen.

The other type of scrolling is called *internal scrolling* (sometimes "pane scrolling"), and it is set up by passing the \texttt{output-pane} initarg \texttt{:pane-can-scroll t}. In general, internal scrolling is more complex to use, but allows more flexible scrolling.

In internal scrolling, the drawing is done in coordinates with respect to the visible area. Input interactions are done as in ordinary scrolling, in particular the coordinates in the callbacks of the \texttt{input-model} take scrolling into account. Scrolling gestures by the user does not actually perform scrolling, and you need to use \texttt{:scroll-callback}. The \texttt{scroll-callback} is responsible for doing something to ensure that "scrolling" happened.

In general, the \texttt{scroll-callback} will have to use some of the functions \texttt{set-vertical-scroll-parameters}, \texttt{set-horizontal-scroll-parameters}, \texttt{get-vertical-scroll-parameters} and \texttt{get-horizontal-scroll-parameters} to get and set scroll values. Some of these values may be set by \texttt{:scroll-*} initargs of \texttt{output-pane}. See \texttt{set-vertical-scroll-parameters} for the details. \texttt{scroll-callback} may also do other computations.

Once it has performed its setups \texttt{scroll-callback} needs to ensure display, by calling \texttt{invalidate-rectangle} on the area (or on each of multiple areas) that need(s) to be redisplayed.
For example how \textit{pane-can-scroll} can be used to implement operations other than simple scrolling see:

\begin{verbatim}
(example-edit-file "capi/output-panes/pane-can-scroll")
\end{verbatim}

### 12.5 Transient display on output-pane and subclasses

It is quite often that you want to transiently add some drawing on top of the permanent drawing of an \textit{output-pane}. Most typically, you want to allow the user to select an area by dragging the mouse while pressing a button, and you want to include some transient graphics to indicate what they are going to select. This could simply be a rectangle, but you may want something more complex.

Ideally, the display-callback of the pane would be fast enough to handle this, in which case you simply need to make the display-callback draw the transient graphics. For example, in the case of a \textit{pinboard-layout}, it can be done by adding a transient \textit{pinboard-object} above the other objects. This is demonstrated by the "outliner" example:

\begin{verbatim}
(example-edit-file "capi/graphics/pinboard-test")
\end{verbatim}

Note that in this case the outliner's drawing is simple, but it could draw much more complex graphics if required.

However, that solution does not work well if the display-callback is not fast enough for these situations. The Cached Display functionality is intended to be used in this case. There are two ways to use the Cached Display interface:

1. Use \textit{output-pane-cache-display} to cache the display, and then \textit{output-pane-draw-from-cached-display} to draw from the cache. In this case you have to ensure that the display-callback knows when to use \textit{output-pane-draw-from-cached-display}, either by replacing the display-callback for the duration of the Cached Display operation or by keeping a flag that the display-callback checks, for example:

\begin{verbatim}
(if (drawing-by-cached-display-p pane)
 (progn
  (output-pane-draw-from-cached-display pane x y width height)
  (do-some-transient-drawing pane))
 (real-display-callback pane x y width height))
\end{verbatim}
2. Use `start-drawing-with-cached-display`, which replaces the `display-callback`, and then use `update-drawing-with-cached-display` or `update-drawing-with-cached-display-from-points` to update the display. This technique is illustrated in

```
(example-edit-file "capi/output-panes/cached-display")
```

In both cases you finish using the cached display by calling `output-pane-free-cached-display`. The function `output-pane-cached-display-user-info` can be used to hold temporary data during the operation.
12 Creating Panes with Your Own Drawing and Input
13

Drawing - Graphics Ports

13.1 Introduction

Graphics Ports allow you to write source-compatible applications which draw text, lines, shapes and images, for different host window systems. Graphics Ports are the destinations for the drawing primitives. They are implemented with a generic host-independent part and a small host-specific part.

All Graphics Ports symbols are exported from the graphics-ports package, nicknamed gp.

Graphics Ports implement a set of drawing functions and a mechanism for specifying the graphics state to be used in each drawing function call. There are four categories of graphics ports:

On-screen ports These correspond to visible windows. They are instances of output-pane or a subclass, and are integral part of the CAPI panes system. The functionality of output-pane (other than drawing) is discussed in Chapter 12, “Creating Panes with Your Own Drawing and Input”.

Pixmap ports These are solely for off-screen drawing. Once the drawing is completed they can be copied to another port (typically an on-screen port, with `copy-area`), or converted to an image. For the details see “Pixmaps and Metafiles” on page 206.

Printer ports These are used for drawing to a printer. Printing is described in Chapter 16, “Printing from the CAPI—the Hardcopy API”.

Metafile ports These are used for recording drawing operations so that the drawing can be realized later or exported to a file that can read by other applications. For the details see “Pixmaps and Metafiles” on page 206.

### 13.1.1 Creating instances

Graphics ports instances are created or temporarily redirected by any of these interfaces:

- **On-screen ports** `make-instance` with `output-pane` or any subclass (including `editor-pane`, `pinboard-layout` and `graph-pane`).
- **Pixmap ports** `create-pixmap-port` and `with-pixmap-graphics-port`.
- **Metafile ports** `with-internal-metafile` and `with-external-metafile`.
- **Printer ports** `with-print-job` and `simple-print-port`.

For the details, see the manual pages for the various CAPI and GRAPHICS-PORTS classes listed above.

### 13.1.2 Pixmaps and Metafiles

Pixmaps are graphics ports for doing off-screen drawing. You create a pixmap with `with-pixmap-graphics-port` or `create-pixmap-port`, and draw on it using the drawing functions. You draw the contents of the pixmap on another port (any kind of port) by copying it (using `copy-area`), or create an image
from it using `make-image-from-port`. The drawing into and the using of a pixmap can be interleaved (but not in parallel), and each time you use the pixmap you get the result of all the drawing operations on it until this point. If the pixmap is created by `with-pixmap-graphics-port` it is destroyed on exiting the scope of `with-pixmap-graphics-port`, otherwise you will need to destroy the pixmap when you finish with it (using `destroy-pixmap-port`).

Pixmaps are used for efficiency. In general `copy-area` would be much faster than doing the drawing operations again for any significant number of drawing operations. It is especially useful for drawing inside the `display-callback` of an output-pane, which is called whenever part of the output pane needs redrawing, and needs to be fast to look good.

Pixmaps are also useful way of creating your own images for exporting with `externalize-and-write-image`.

Examples of using pixmaps:

```lisp
(example-edit-file "capi/graphics/compositing-mode-simple")
(example-edit-file "capi/graphics/compositing-mode")
(example-edit-file "capi/graphics/image-scaling")
(example-edit-file "capi/graphics/images-with-alpha")
(example-edit-file "capi/graphics/pixmap-port")
(example-edit-file "capi/graphics/plot-offline")
```

Metafiles are graphics ports that record drawing operations to them. They are used for two purposes:

- Grouping drawing operations together. The operations can then be drawn by one call, and on Cocoa and Windows can also be put in on the clipboard so that another process can access it.
- Exporting the drawing to a file. The file is in a format that other applications can also use.

You can group operations by drawing to a metafile inside `with-internal-metafile` which returns a metafile object, and later drawing the metafile by using `draw-metafile`. You can also convert it directly to an image by `draw-`
metafile-to-image. Once you have finished with it you need to free the metafile by free-metafile.

It is possible to perform the same task by drawing the operations to a pixmap and then drawing the pixmap, as described above. However, a metafile gives much better results when it is transformed, because it does the drawing with the transformation, while with a pixmap the transformation transforms the pixels. Metafiles also give better results when the drawing is not completely opaque.

The result of with-internal-metafile can also be put on the clipboard for other processes, by using set-clipboard with a :plist (list :metafile metafile). LispWorks can also read a metafile from the clipboard by passing :metafile as the format to clipboard.

You can export the drawing to a file by drawing to a metafile inside using with-external-metafile, which creates the file when it exits.

On Microsoft Windows it creates a Windows enhanced metafile (there are several possible formats). On Cocoa and GTK+ it creates a PDF file.

Compared to exporting images (using with-pixmap-graphics-port, make-image-from-port, and externalize-and-write-image), the exported metafiles (PDF or Windows metafile) behave much better in transformation and combination with other drawings. They are also simpler to use.

LispWorks itself can read the file that was created by with-external-metafile using the functions that read images (load-image, read-external-image).

Metafile functionality is not available on version of GTK+ before 2.8, and on Motif. The function can-use-metafile-p can be used to check whether the GUI system associated with a screen supports metafile functionality.

Examples of metafiles:

```
(example-edit-file "capi/graphics/metafile")
(example-edit-file "capi/graphics/metafile-rotation")
```
13.2 Features

The main features of graphics ports are:

1. Each port has a “graphics state” which holds all the information about drawing parameters such as color, line thickness, fill pattern, line-end-style and so on. A graphics state object can also be created independently of any particular graphics port.

2. The graphics state contents can either be enumerated in each drawing function call, bound to values for the entirety of a set of calls, or permanently changed.

3. The graphics state includes a transform which implements generalized coordinate transformations on the port’s coordinates.

4. Off-screen ports can compute the horizontal and vertical bounds of the results of a set of drawing function calls, thus facilitating image or pixmap generation.

13.2.1 The drawing mode and anti-aliasing

Graphics ports has two drawing modes:

:compatible  Compatible with LispWorks 6.0 and earlier versions
:quality     Introduced in LispWorks 6.1, allowing high quality drawing

The main visible effect is that with drawing-mode :quality, all drawings are transformed properly.

With drawing-mode :compatible, strings and images are not scaled or rotated at all, and ellipses are not rotated correctly. Other shapes are transformed "at the front", that is they are drawn as if the drawing function was called with transformed coordinates. The target of copy-pixels is also transformed "at the front", that is the rectangle can be translated, but not scaled or rotated.

With drawing-mode :quality, all drawings are fully transformed correctly. Shapes are transformed "at the back", that is they are drawn and then the result of the drawing is transformed. Note that clear-rectangle and pixblt are not drawing functions in this sense, and do not take transforms into account.
Another difference is that `drawing-mode :quality` supports anti-aliasing on Windows, and on GTK+ it adds control over anti-aliasing. See `shape-mode` and `text-mode` on the page for `graphics-state`.

With `drawing-mode :quality` the operation value in the `graphics-state` is not supported and is ignored. This is because operations do not combine sensibly with anti-aliasing and colors with alpha components. Instead, there is now `compositing-mode`. For more information see the page for `graphics-state`.

On Microsoft Windows with `drawing-mode :quality` only Truetype fonts are supported.

The `drawing-mode` of all graphics ports is :quality by default, except when a graphics port is made in association with another graphics ports (for example, by `create-pixmap-port`), in which case the `drawing-mode` is inherited from the “parent” graphics port.

All the interfaces that create graphics ports, or modify a graphics port to draw to another place, take keyword argument :drawing-mode. Its value `drawing-mode` can be :quality, :compatible, or nil which is interpreted as use the default (either inherited or the global default :quality). These interfaces are listed in “Creating instances” on page 206.

These examples demonstrate features that are available only with `drawing-mode :quality`:

Rotating a string:

```
(example-edit-file "capi/graphics/catherine-wheel")
```

Using `compositing-mode`.

```
(example-edit-file "capi/graphics/compositing-mode-simple")
```

Using `compositing-mode`.

```
(example-edit-file "capi/graphics/compositing-mode")
```

Using `compositing-mode`, transforming an image.

```
(example-edit-file "capi/graphics/images-with-alpha")
```
13.3 Graphics state

The **graphics-state** object associated with each port holds values for parameters such as foreground, background, operation, thickness, scale-thickness, mask and font which affect graphics ports drawing to that port.

The full set of parameters is described under **graphics-state**.

13.3.1 Setting the graphics state

The graphics state values associated with a drawing function call are set by one of three mechanisms.

1. Enumeration in the drawing function call. For example:

   ```lisp
   (draw-line port 1 1 100 100
              :thickness 10
              :scale-thickness nil
              :foreground :red)
   ```

2. Bound using macros such as **with-graphics-state**. For example:

   ```lisp
   (with-graphics-state (port :thickness 10
                              :scale-thickness nil
                              :foreground :red)
   (draw-line port 1 1 100 100)
   (draw-rectangle port 2 2 40 50 :filled t))
   ```

   For common cases of locally changing the transform in the graphics state, there are specific macros:

   - **with-graphics-transform** just changes the transform like **with-graphics-state** with :transform.
   - **with-graphics-transform-reset** allows you to ignore surrounding transformations.
   - **with-graphics-translation, with-graphics-post-translation, with-graphics-scale and with-graphics-rotation** perform commonly-used transformations.
   - **with-graphics-mask** affects specifically the masking slots.

3. Set by the **set-graphics-state** function. For example:
The first two mechanisms change the graphics state temporarily. The last one changes it permanently in `port`, effectively altering the “default” state.

### 13.4 Drawing functions

The section describes the various shapes and so on that you can draw with graphics ports, and lists the relevant drawing functions. The graphics state `foreground` parameter is used for the drawing color.

All drawing functions must be called in the same process as the pane. You will need to arrange for that explicitly in contexts other than callbacks on that pane. To call a function explicitly in the pane’s process, use `apply-in-pane-process`, `apply-in-pane-process-if-alive`, `execute-with-interface` or `execute-with-interface-if-alive`.

**Note**: Unlike images, the `foreground` and `background` colors used when drawing shapes described in this section are not pre-multiplied. Displaying images is described in “Working with images” on page 219.

**Note**: The full set of graphics state parameters is described under `graphics-state`.

#### 13.4.1 Text

You can draw text with the functions `draw-string` and `draw-character`.

To control the font used, see “Portable font descriptions” on page 217.

#### 13.4.2 Simple lines

You can draw straight lines with the functions `draw-line` and `draw-lines`.

You can draw arcs of an ellipse with the functions `draw-arc` and `draw-arcs`.

#### 13.4.3 Simple shapes

You can draw ellipses and polygons with the functions `draw-ellipse`, `draw-rectangle`, `draw-rectangles`, `draw-polygon` and `draw-polygons`.
You can specify whether a shape is drawn in outline or is filled (with the graphics state foreground color) by the argument filled.

For example, to clear a rectangular region of an output pane, do

```
(draw-rectangle pane x y width height
  :filled t
  :foreground color
  :compositing-mode :copy
  :shape-mode :plain)
```

:compositing-mode :copy is needed only when the color has alpha, and :foreground color is needed only if it is different from the foreground in pane's graphics-state.

### 13.4.4 Paths

A graphics path is a series of lines, arcs and Bézier curves that together specify one or more disconnected figures to be drawn.

You can draw a path with the function `draw-path`.

A path can be drawn in outline or can be filled. A path can also be used as the clipping mask.

### 13.5 How to draw to an on-screen port

Drawing on an output-pane should almost always happen only inside its display-callback. See output-pane for more information about this initarg.

If you want to display from outside the display-callback then you should call invalidate-rectangle, which will cause the display-callback to be called.

### 13.6 Graphics state transforms

Coordinate systems for windows generally have the origin (0,0) positioned at the upper left corner of the window with X positive to the right and Y positive downwards. This is the “window coordinates” system. Generalized coordinates are implemented using scaling, rotation and translation operations such that any Cartesian coordinates can be used within a window. The Graphics Ports system uses a transform object to achieve this.
13.6.1 Generalized points

An (x, y) coordinate pair can be transformed to another coordinate system by scaling, rotation and translation. The first two can be implemented using 2 x 2 matrices to hold the coefficients:

If the point $P$ is $(a, b)$ and it is transformed to the point $Q (a', b')$

\[ P \Rightarrow Q \text{ or } (a, b) \Rightarrow (a', b') \]

\[ a' = pa + rb, \quad b' = qa + sb. \]

\[ Q = PM, \quad \text{where} \quad M = \begin{bmatrix} p & q \\ r & s \end{bmatrix} \]

Translation can be included in this if the points $P$ and $Q$ are regarded as 3-vectors instead of 2-vectors, with the 3rd element being unity:

\[ Q = PM \]
\[ = (a \ b \ 1) \begin{bmatrix} p & q & 0 \\ r & s & 0 \\ u & v & 1 \end{bmatrix} \]

The coefficients $u$ and $v$ specify the translation.

So, the six elements $(p, q, r, s, u, v)$ of the 3 x 3 matrix contain all the transformation information. These elements are stored in a list (of type `transform`) in the `graphics-state` slot `transform`.

Transforms can be combined by matrix multiplication to effect successions of translation, scaling and rotation operations.

Functions are provided in Graphics Ports which apply translation, scaling and rotation to a transform, combine transforms by pre- or post-multiplication, invert a transform, perform some operations while ignoring an established transform, and so on. The macros `with-graphics-rotation`, `with-graphics-scale` and `with-graphics-translation` pre-multiply a supplied transform while a body of code is executed.
13.6.2 Drawing on screen

Drawing functions such as `draw-line` and `draw-ellipse` modify pixels, but you cannot assume that they have exactly the same effect on all platforms. Some platforms might put pixels below and to the right of integer coordinates \((x\ y)\) while others may center the pixel at \((x\ y)\).

This applies to all the drawing functions which are documented in Chapter 22, “GRAPHICS-PORTS Reference Entries” - see the entries for functions with names beginning `draw-`.

13.7 Combining source and target pixels

This section describes how new drawings are combined with the existing pixel values in the target of the drawing to generate the result, according to graphics state parameters `compositing-mode` or `operation`.

**Note:** The full set of graphics state parameters is described under `graphics-state`.

13.7.1 Combining pixels with :compatible drawing

When the port’s `drawing-mode` is :compatible the graphics state parameter `operation` determines how the colors are combined, and `compositing-mode` is ignored.

The allowed values of `operation` are the values of the Common Lisp constants `boole-1`, `boole-and` and so on. These are the allowed values of the first argument to the Common Lisp function `boole`. See the specification of `boole` in the ANSI Common Lisp standard for the full list of operations.

The color combination corresponds to the logical operation defined there, as if by calling

\[
(\text{boole} \ operation \ new\text{-}pixel \ screen\text{-}pixel)
\]

For example, passing :operation `boole-ander2` provides a `graphics-state` where graphics ports drawing functions draw with the bitwise AND of the foreground color and the complement of the existing color of each pixel.

**Note:** Graphics State `operation` is not supported by Cocoa/Core Graphics so this parameter is ignored on Cocoa.
13.7.2 Combining pixels with :quality drawing

When the port’s drawing-mode is :quality the graphics state parameter compositing-mode determines how the colors are combined, and operation is ignored.

compositing-mode :over means draw over the existing values, blending alpha values if they exist.

compositing-mode :copy means that the source is written to the destination ignoring the existing values. If the source has alpha and the target does not, that has the effect of converting semi-transparent source to solid. :copy is especially useful for creating transparent and semi-transparent pixmap ports, which can be displayed directly or converted to images by make-image-from-port.

Further compositing-mode values are supported on later versions of Cocoa and GTK+.

13.8 Pixmap graphics ports

Pixmap graphics ports are drawing destinations which exist only as pixel arrays whose contents are not directly accessible. They can be drawn to using the draw-thing functions and images can be loaded using load-image, and their contents can be copied onto other graphics ports. However this copying can be meaningless unless the conversion of colors uses the same color device on both ports. Because color devices are associated with regular graphics ports (windows) rather than pixmap graphics ports, you have to connect a pixmap graphics port to a regular graphics port for color conversion. This is the main role of the port argument of with-pixmap-graphics-port and create-pixmap-port. The conversion of colors to color representations is done in the same way as for regular graphics ports, but the pixmap graphics port’s owner is used to find a color device. You can draw to pixmap graphics ports using pre-converted colors to avoid color conversion altogether, in which case a null color owner is OK for a pixmap graphics port.
13.8.1 Relative drawing in pixmap graphics ports

Many of the drawing functions have a relative argument. If non-nil, it specifies that when drawing functions draw to the pixmap, the extremes of the pixel coordinates reached are accumulated. If the drawing strays beyond any edge of the pixmap port (into negative coordinates or beyond its width or height), then the drawing origin is shifted so that it all fits on the port. If the drawing extremes exceed the total size available, some are inevitably lost. If relative is nil, any part of the drawing which extends beyond the edges of the pixmap is lost. If relative is nil and collect non-nil, the drawing bounds are collected for later reading, but no relative shifting of the drawing is performed. The collected bounds are useful when you need to know the graphics motion a series of drawing calls causes. The rest args are host-dependent. They usually include a :width and :height pair.

13.9 Portable font descriptions

Portable font descriptions are designed to solve the following problems:

- Specify enough information to uniquely determine a real font.
- Query which real fonts match a partial specification.
- Allow font specification to be recorded and reused in a later run.

All the functions described below are exported from the gp package.

You can obtain the names of all the fonts which are available for a given pane by calling list-all-font-names, which returns a list of partially-specified font descriptions.

Portable font descriptions are used only for lookup of real fonts and for storing the parameters to specify when doing a font lookup operation. To draw text in a specified font using the Graphics Ports drawing functions, supply in the graphics state a font object as returned by find-matching-fonts and find-best-font.

13.9.1 Font attributes and font descriptions

Font attributes are properties of a font, which can be combined to uniquely specify a font on a given platform. There are some portable attributes which
can be used on all platforms; other attributes are platform-specific and will be ignored or signal errors when used on the wrong platform.

Font descriptions are externalizable objects which contain a set of font attributes. When using a font description in a font lookup operation, missing attributes are treated as wildcards (as are those with value :wild) and invalid attributes signal errors. The result of a font lookup contains all the attributes needed to uniquely specify a font on that platform.

The :stock font attribute is special: it can be used to reliably look up a system font on all platforms.

Font descriptions can be manipulated using the functions merge-font-descriptions and augment-font-description.

These are the current set of portable font attributes and their portable types:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Possible values</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>:family</td>
<td>string</td>
<td>Values are not portable.</td>
</tr>
<tr>
<td>:weight</td>
<td>(member :normal :bold)</td>
<td></td>
</tr>
<tr>
<td>:slant</td>
<td>(member :roman :italic)</td>
<td></td>
</tr>
<tr>
<td>:size</td>
<td>(or (eql :any) (integer 0 *))</td>
<td>:any means a scalable font</td>
</tr>
<tr>
<td>:stock</td>
<td>(member :system-font :system-fixed-font)</td>
<td>Stock fonts are guaranteed to exist.</td>
</tr>
<tr>
<td>:charset</td>
<td>keyword</td>
<td></td>
</tr>
</tbody>
</table>

### 13.9.2 Fonts

Fonts are the objects which are actually used in drawing operations. They are made by a font lookup operation on a pane, using a font description as a pattern.
Examples of font lookup operations are `find-best-font` and `find-matching-fonts`.

Once a font object is resolved you can read its properties such as height, width and average width. The functions `get-font-height`, `get-font-width` and `get-font-average-width` and so on need a pane that has been created. In general, you need to call these functions within `interface-display`, or a `display-callback` or possibly a `create-callback`. See the manual page for `interface` for more information about these initargs.

### 13.9.3 Font aliases

You can define font aliases, which map a keyword symbol to some font or font description, using `define-font-alias`. You can then use this the keyword as the `font` for CAPI panes.

### 13.10 Working with images

Graphics Ports supports drawing images, and also reading/writing them from/to file via your code. A wide range of image types is supported. Also, several CAPI classes support the same image types.

To draw an image with Graphics Ports, you need an `image` object which is associated with an instance of `output-pane` (or a subclass of this). You can create an `image` object from:

- A file of recognized image type.
- A registered image identifier (see “Registering images”).
- An `external-image` object.
- A graphics port.

Draw the image to the pane by calling `draw-image`. Certain images ("Plain Images") can be manipulated via the Image Access API. The image should be freed by calling `free-image` when you are done with it.

The CAPI classes `image-pinboard-object`, `button`, `list-panel`, `list-view`, `tree-view`, `toolbar`, `toolbar-button` and `toolbar-component` all support images. There is also limited support for images in `menu`. These classes handle the drawing and freeing for you.
13.10.1 Image formats supported for reading from disk and drawing

This table lists the formats supported at the time of writing:

Table 13.2 Operating system and supported image types

<table>
<thead>
<tr>
<th>OS</th>
<th>Supported Image Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Windows</td>
<td>BMP, DIB, GIF, JPEG, PNG, TIFF, EMF, ICO</td>
</tr>
<tr>
<td>Mac OS X</td>
<td>BMP, DIB, GIF, JPEG, TIFF, PICT and many others.</td>
</tr>
<tr>
<td></td>
<td>Also EPS, PDF</td>
</tr>
<tr>
<td>GTK+</td>
<td>BMP, DIB, GIF, JPEG, PNG, TIFF and many others.</td>
</tr>
<tr>
<td>X/Motif</td>
<td>BMP, DIB, GIF, JPEG, PNG, TIFF, XPM, PGM, PPM</td>
</tr>
</tbody>
</table>

Functions which load images from a file attempt to identify the image type from the file type.

Call the function `list-known-image-formats` to list the formats that the current platform supports for reading and drawing.

**Note:** On X/Motif LispWorks uses the freeware `imlib` library which seems to be in all Linux distributions. However it is not in some UNIX systems, so you may need to install it.

**Note:** On Microsoft Windows ICO images are supported for certain situations such as buttons and drawing images. See `button` and `draw-image` for details.

**Note:** On Microsoft Windows LispWorks additionally supports Windows Icon files with scaling - see `load-icon-image` for details.

**Note:** On Microsoft Windows, only bitmaps with maximum 24 bits per pixel are supported.

**Note:** LispWorks 4.3 and previous versions supported only Bitmap images.
13.10.2 Image formats supported for writing to disk

Graphic images can be written to files in several formats, using `externalize-and-write-image`.

All platforms can write at least BMP, JPG, PNG and TIFF files. Call the function `list-known-image-formats` with optional argument `for-writing-too` to list the formats that the current platform supports for writing.

On Microsoft Windows and Cocoa you can also write GIF files, while on GTK+ you can also write ICO and CUR (cursor) files. The cursor files that are written with GTK+ can be used on Windows and Cocoa, although on Cocoa it does not recognize the hot-spot in a CUR file.

There is a simple example of writing a PNG image here:

```
(example-edit-file "capi/graphics/images-with-alpha")
```

13.10.3 External images

An External Image is an intermediate object. It is a representation of a graphic but is not associated with a port and cannot be used directly for drawing. It is a Lisp object which can be loaded into Lisp and saved in a LispWorks image created by `save-image` or `deliver`.

An object of type `external-image` is created by reading an image from a file, or by externalizing an `image` object, or by copying an existing `external-image`. Or, if you have the image bitmap data, you can create one directly as in this example:

```
(example-edit-file "capi/buttons/button")
```

The `external-image` contains the bitmap data, potentially compressed. You can copy `external-image` objects, or write them to file, or compress the data.

You cannot query the size of the image in an `external-image` object directly. To get the dimensions without actually drawing it on screen see “Pixmap graphics ports” on page 216.

An `external-image` can be written to a file using `write-external-image`. If you create an `image` and want to externalize it to write it to file, follow this example:
(let ((image (gp:make-image-from-port pane 10 10 200 200)))
  (unwind-protect
    (gp:externalize-and-write-image pane image filename)
    (gp:free-image pane image)))

13.10.3.1 Converting an external image

Convert an external-image to an object of type image ready for drawing to a port in several ways as described in “Making an image that is suitable for drawing”. Such conversions are cached but you can remove the caches by clear-external-image-conversions.

You can also convert an image to an external-image by calling externalize-image.

13.10.3.2 Transparency and the alpha channel

Graphics ports images support an alpha channel, as long as the image format does.

An External Image representing an image in a format with a color table but with no alpha channel (such as 8-bit BMP) can simulate transparency by specifying an index to represent the transparent color. When converted this color is replaced by the background color of the port (which is documented in simple-pane).

You can specify the transparent color by

  (gp:read-external-image file :transparent-color-index 42)

or by

  (setf (gp:external-image-transparent-color-index external-image) 42)

You can use an image tool such as Gimp (www.gimp.org) to figure out the transparent color index.

On platforms other than Motif you can actually make the background of such an image format truly transparent when displayed. To do this, supply transparent-color-index as a cons (index . :transparent).
Note: transparent-color-index works only for images with a color map - those with 256 colors or less.

13.10.4 Registering images

One way to load an image is via a registered image identifier.

Registering an external image is the way to pre-load images while building an application. To do this, establish a registered image identifier by calling register-image-translation at build time:

```lisp
(gp:register-image-translation
 'info-image
 (gp:read-external-image "info.bmp" :transparent-color-index 7))
```

Then at run time obtain the image object by:

```lisp
(gp:load-image port 'info-image)
```

13.10.5 Making an image that is suitable for drawing

To create an image object suitable for drawing on a given pane, use one of convert-external-image, read-and-convert-external-image, load-image, make-image-from-port, make-sub-image or (on Microsoft Windows) load-icon-image.

Images need to be freed after use. When the pane that an image was created for is destroyed, the image is freed automatically. However if you want to remove the image before the pane is destroyed, you must make an explicit call free-image. If the image is not freed, then a memory leak will occur.

Another way to create an image object is to supply a registered image identifier in a CAPI class that supports images. For example you can specify an image in an image-pinboard-object. Then, an image object is created implicitly when the pinboard object is displayed and freed implicitly when the pinboard object is destroyed.

In all cases, the functions that create the image object require the pane to be already created. So if you are displaying the image when first displaying your window, take care to create the image object late enough, for example in the
13.10.6 Querying image dimensions

To obtain the pixel dimensions of an image, load the image using \texttt{load-image} and then use the readers \texttt{image-width} and \texttt{image-height}. The first argument to \texttt{load-image} must be a pane in a displayed interface.

To query the dimensions before displaying anything you can create and "display" an interface made with the \texttt{:display-state :hidden} initarg. Call \texttt{load-image} with this hidden interface and your \texttt{external-image} object, and then use the readers \texttt{image-width} and \texttt{image-height}.

13.10.7 Drawing images

The function to draw an image is \texttt{draw-image}.

As with the other drawing functions, this must be called in the same process as the pane, as outlined in “Drawing functions” on page 212.

13.10.8 Image access

You can read and write pixel values in an \texttt{image} via an Image Access object, but only if the image is a Plain Image. You can ensure you have a Plain Image by using the result of

\begin{verbatim}
(load-image pane image :force-plain t)
\end{verbatim}

To read and/or write pixel values, follow these steps:

1. Start with a Graphics Port (for example an \texttt{output-pane}) and an \texttt{image} object associated with it, which is a Plain Image. See above for how to create an \texttt{image} object.

2. Construct an Image Access object by calling \texttt{make-image-access}.

3. To read pixels from the image, first call \texttt{image-access-transfer-from-image} on the Image Access object. This notionally transfers all the pixel data from the window system into the access object. It might do nothing if the window system allows fast access to the pixel data directly. Then call \texttt{image-access-pixel} with the coordinates of each
13.10 Working with images

pixel (or use `image-access-pixels-to-bgra`). The values are color representations like those returned from `convert-color` and can be converted to RGB using `unconvert-color` if required.

4. To write pixels to the image, you must have already called `image-access-transfer-from-image`. Then call `(setf image-access-pixel)` with the coordinates of each pixel (or use `image-access-pixels-from-bgra`) to write pre-multiplied pixel RGB values and then call `image-access-transfer-to-image` on the Image Access object. This notionally transfers all the pixel data back to the window system from the access object. It might do nothing if the window system allows fast access to the pixel data directly.

5. Free the image access object by calling `free-image-access` on it.

It is also possible to get all the pixels into a single vector, where each color is represented by four elements, using `image-access-pixels-from-bgra`, and to change all the pixels in the image to values from a vector using `image-access-pixels-to-bgra`. When accessing many pixels, using these functions and accessing the vector is much faster than using the single pixel access.

There is an example that demonstrates the uses of Image Access objects in:

(example-edit-file "capi/graphics/image-access")

This further example demonstrates the uses of Image Access objects with colors that have an alpha component:

(example-edit-file "capi/graphics/image-access-alpha")

13.10.8.1 Pre-multiplied pixel values in images

The color values that are received and set using Image Access are premultiplied, which means that the value of each of the three components (Red, Green and Blue) are already multiplied by the value of the alpha. This is different from the way colors are represented elsewhere. The functions `color-to-premultiplied` and `color-from-premultiplied` can be used the convert between premultiplied colors and ordinary colors, although they lose some precision in the process.
For example, the form below creates an image from a pixmap filled with a color that has alpha 0.5. When accessing the image using Image Access, the values in the color that it returned are half of the values in the original color.

(let* ((initial-color (color:make-rgb 0.8 0.6 0.4 0.5))
   (image-pixel
    (let ((pane (capi:editor-pane
                    (capi:find-interface 'lw-tools:listener))))
      ;; Make a temporary pixmap filled with the initial-color and create a gp:image from it
      (let ((image (gp:with-pixmap-graphics-port
                     (pixmap pane 10 10
                          :background initial-color
                          :clear t)
                     (gp:make-image-from-port pixmap)))
        ;; Create a gp:image-access, read a pixel and unconvert it
        (let ((image-access (gp:make-image-access
                              pane image)))
          (gp:image-access-transfer-from-image
           image-access)
          (let ((pixel (color:unconvert-color
                         pane
                         (gp:image-access-pixel
                          image-access 0 0)))
            (gp:free-image-access image-access)
            (gp:free-image pane image)
            pixel))))))
  (flet ((output-color (string color)
           (format t "~%~a~28t: Red ~4,2f, Green ~4,2f, Blue ~4,2f"
                    string (color:color-red color) (color:color-green color) (color:color-blue color)))
         (output-color *Initial-color*
                       initial-color)
         (output-color *premultiplied*
                       (color:color-to-premultiplied initial-color))
         (output-color *In the image*
                       image-pixel)
         (output-color *Pixel un-premultiplied*
                       (color:color-from-premultiplied image-pixel))))
13.10.9 Creating external images from Graphics Ports operations

To create an external-image object from graphics ports operations, use with-pixmap-graphics-port, and in the scope of it do the drawing and then use make-image-from-port to create an image object. You can then use externalize-image or externalize-and-write-image to externalize the image.

```lisp
(defun record-picture (output-pane)
  (gp:with-pixmap-graphics-port
    (port output-pane
      400 400
      :clear t
      :background :red)
    (gp:draw-rectangle port 0 0 200 200
      :filled t
      :foreground :blue)
    (let ((image (gp:make-image-from-port port)))
      (gp:externalize-image port image)))
)
```

Here output-pane must be a displayed instance of output-pane (or a subclass). The code does not affect the displayed pane.

If you do not already display a suitable output pane, you can create an invisible one like this:

```lisp
(defun record-picture-1 ()
  (let* ((pl (make-instance 'capi:pinboard-layout))
         (win (capi:display (make-instance 'capi:interface
                                  :display-state :hidden
                                  :layout pl))))
    (prog1 (record-picture pl)
            (capi:destroy win))))
```

Note: There is no reason to create and destroy the invisible interface each time a new picture is recorded, so for efficiency you could cache the interface object and use it repeatedly.
14

Graphic Tools drawing objects

The drawing objects of Graphic Tools add a mechanism to creates a hierarchy of drawing, when a “drawing” is (typically) a simple Graphics Ports drawing operation. The hierarchy specifies the geometry of each node in the hierarchy, so the whole group of drawings can be manipulated as a single object.

The lower level interface allows you to create drawing objects and manipulate them. The higher level interface allows you to generate graphs of functions or bar charts, where "generate" means create a hierarchy of drawing objects. The higher level functions are useful on their own, but they also give examples of how to create high-level objects from drawing objects. You can look at their output to get a better idea how to write your own Graphic Tools code.

The Graphic Tools interface is defined in the package LW-GT. To use it, you need to load the "graphic-tools" module:

```
(require "graphics-tools")
```

14.1 Lower level - drawing objects and objects displayers

The drawing objects are instances of subclasses of the `drawing-object`. The term "drawing-object-spec" refers to either a `drawing-object` or a list of "drawing-object-specs". The drawing objects hierarchy is made of "drawing-object-specs".
The leaf nodes in the hierarchy are `drawing-objects` which actually do the drawing, typically by calling a Graphics Ports drawing function (for example `draw-line`). You generate such a `drawing-object` by using any of the `lw-gt:make-draw-*` functions, for example `make-draw-line`. You can also have a `drawing-object` that calls an arbitrary function by using `make-a-drawing-call`.

The non-leaf nodes in the hierarchy are made by instances of `compound-drawing-object`. `compound-drawing-object` has a `sub-object` slot, which contains a "drawing-object-spec" (either a list of "drawing-object-specs" or a `drawing-object`). Since the elements in lists are themselves "drawing-object-specs", that is can also be lists, part of the hierarchy can be done in lists of lists.

The main function of `compound-drawing-object` is to define the geometry of the drawing. The actual objects are instances of `geometry-drawing-object` which is a subclass of `compound-drawing-object`. These objects define the geometry, by rebinding the Graphics Ports transform, and then drawing their `sub-object` in this context. The width and height of the `compound-drawing-object` are also passed down, so `geometry-drawing-objects` inside the `sub-object` can use it when computing their own geometry.

You create a `geometry-drawing-object` by using one of:

- `position-object`  
  Defines the rectangle for drawing the `sub-object`.

- `fit-object`  
  Scales its `sub-object`.

- `position-and-fit-object`  
  Both positions and scales.

- `rotate-object`  
  Rotates its `sub-object`.

- `make-absolute-drawing*` and `make-absolute-drawing`
  Draw their `sub-object` in the translated position, but without scaling or rotation.

Lists just draw their elements in the same geometry as their "parent".

To actually be drawn, the root of the hierarchy must be stored in the `drawing-object` slot of an "objects displayer", which is either an `objects-displayer` (subclass of `pinboard-layout`), or `pinboard-objects-displayer` (subclass...
of pinboard-object). The objects-displayer or pinboard-objects-displayer displays the hierarchy starting from the object in their drawing-object slot, passing its own geometry. The object in the drawing-object slot will typically be a list (which then draws its elements) or a compound-drawing-object (which then draws its sub-object with modified geometry). This process recurses and draws the entire hierarchy.

By default, both objects-displayer and pinboard-objects-displayer use an internal metafile as a way to cache the drawing and also to improve resizing.

drawing-objects do not have a permanent notion of “parent”, and can appear concurrently as “children” of many “parents”, and the same applies to a list in the hierarchy. The objects do not have any specific thread information and drawing does not modify anything in the objects. Therefore “drawing-object-specs” can appear concurrently in many places, whether inside the same hierarchy or in different hierarchies.

For example, the following do-object function takes an object, and positions it at the bottom (with no positioning), middle and top. It then groups these three occurrences in a list (“drawing-object-spec”). It then uses “drawing-object-spec” twice, once inside pinboard-objects-displayer, and once in an objects-displayer that also displays the pinboard-objects-displayer. Thus the object is displayed six times: bottom, middle and top of the pinboard-objects-displayer, and bottom, middle and top of objects-displayer.
(defun do-object (the-object height)
  (let* ((bottom-one the-object)
          (middle-one
            (lw-gt:position-object the-object
              :bottom-ratio 0.5
              :bottom-margin (/ height -2)))
          (top-one
            (lw-gt:position-object the-object
              :bottom-ratio 1
              :bottom-margin (- height)))
          (drawing-object-spec
            (list bottom-one middle-one top-one))
          (pinboard-object
            (lw-gt:make-pinboard-objects-displayer
drawing-object-spec
              :x 80
              :y 40
              :width 100
              :height 200)))
  (capi:contain
    (make-instance 'lw-gt:objects-displayer
description (list pinboard-object)
  drawing-object drawing-object-spec))))

We then use do-object to display a red rectangle:

   (do-object
     (lw-gt:make-draw-rectangle 0 0 40 20 :filled t :foreground :red) 20)

You see that there are six rectangles. When you resize the pane, the three rectangles on the left, which are the rectangles in the drawing-object slot of the objects-displayer, resize too. That is because the metafile of the objects-displayer resizes. The three rectangles of the pinboard-objects-displayer do not resize, because the pinboard-objects-displayer does not change its size.

The function can be used for more complex objects:
The next example uses `rotate-object`. This first shifts the object to the right and down by using `position-object`, rotates the objects six times, rotating pi/3 each time, around a point which is in the middle of the height of the object, and distance of height to its left. Note that consequently the actual position of the copies is quite different from where `position-object` put them, which is a slightly counter-intuitive feature of `rotate-object` when using a rotating point which is not the center of the object:

```lisp
(defun do-rotating (the-object height)
  (let ((shifted
         (lw-gt:position-object the-object
          :left-margin height
          :bottom-margin (- (/ height 2)))))
    (let* ((rotated-copies
            (loop repeat 6
                for angle from 0 by (/ pi 3)
                collect (lw-gt:rotate-object shifted angle)))
            ;; position the result in the middle of the pane
            (positioned-drawing
             (lw-gt:position-object rotated-copies
              :bottom-ratio 0.5
              :left-ratio 0.5)))
      (capi:contain
       (make-instance 'lw-gt:objects-displayer
                      :drawing-object positioned-drawing)))))
```

and rotate the same object that we used above:

```lisp
(do-rotating
 (list (lw-gt:make-draw-rectangle 0 0 40 20
        :filled t :foreground :red)
       (lw-gt:make-draw-ellipse 20 10 20 10
        :filled t :foreground :blue)
       (lw-gt:make-draw-line 0 10 40 10
        :filled t :foreground :green))
  20)
```
A sub-hierarchy inside a hierarchy can be modified destructively by setting the sub-object slot of compound-drawing-objects in the hierarchy. For example, we use the function do-object above to display rectangles, and then make it switch between rectangles and ellipses:

```lisp
(let ((rect
  (lw-gt:make-draw-rectangle 0 0 40 20
   :filled t :foreground :red))
  (ellipse
   (lw-gt:make-draw-ellipse 20 10 20 10
    :filled t :foreground :blue)))
  (let ((my-object
    ;; Use lw-gt:position-object to create a
    ;; compound-drawing-object, without actual positioning
    (lw-gt:position-object rect)))
    (let ((the-pane (do-object my-object 20)))
      (dotimes (x 20)
        (sleep 0.5)
        ;; modify the hierarchy
        (setf (lw-gt:compound-drawing-object-sub-object my-object)
          (if (evenp x) ellipse rect))
        ;; make it redraw
        (lw-gt:force-objects-redraw the-pane))))
```

In principle you can also modify the hierarchy by setting the cl:car of a cons in a list inside the hierarchy, though that will make your code less clear. Do not set the cl:cdr of conses in these lists.

As the example above shows, you do not need to do modifications in the pane thread (in contrast to operations on CAPI objects). If you modify the hierarchy while it is being drawn, the drawing in this drawing operation may be mixed up. However, normally you will want to force it to redraw using force-objects-redraw, which will draw correctly.

To make it easier to modify objects in the hierarchy, the functions that generate compound-drawing-objects all take keyword arguments data and function, which then are used to update the object automatically by calls to compute-drawing-object-from-data or recurse-compute-drawing-object. For example, the switch example above can be written using this mechanism, without having to remember my-object:
14.1 Lower level - drawing objects and objects displayers

(defun my-updating-function (data)
  (car data))

(let ((data (list nil)))
  (let ((rect
            (lw-gt:make-draw-rectangle 0 0 40 20 :filled t
             :foreground :red))
        (ellipse
            (lw-gt:make-draw-ellipse 20 10 20 10 :filled t
             :foreground :blue)))
    (let ((my-object
            ;; Use position-object to create a compound-drawing-object,
            ;; without actual positioning, but with updating
            ;; information
            (lw-gt:position-object rect
             :function 'my-updating-function
             :data data)))
      (let ((the-pane (do-object my-object 20)))
        (dotimes (x 20)
          (sleep 0.5)
          (setf (car data) (if (evenp x) ellipse rect))
          (lw-gt:recurse-compute-drawing-object the-pane))))

Because drawing-objects do not actually know which hierarchy they are in, they cannot tell their containing pane to redraw. We used force-objects-redraw in the first example above, and in the last example above we rely the fact that recurse-compute-drawing-object, when called on a pane, does this itself. In general, to actually get the pane redrawn, you will have to have a call of some function (force-objects-redraw or a function that calls it) on either the pane or on a pinboard-objects-displayer.

Note that just invalidating the pane (by invalidate-rectangle) does not cause redrawing of the drawing-objects when a metafile is used (the default case). That is intentional, to make exposure and resize fast.

Modifying the hierarchy is thread-safe, in that threads modifying the hierarchy in parallel, and even parallel to it being drawn, will not cause a problem on its own. However there is no guard against different threads making conflicting changes. For example, if thread A sets the sub-object of a compound-drawing-object, and at the same time thread B sets something inside the sub-object, then the change that thread B made will not be visible in the hierarchy. You will have to guard against such conflicts.
The **drawing-object** code cannot cope with a circular hierarchy.

### 14.2 Higher level - drawing graphs and bar charts

The higher level Graphic Tools functions all generate a "drawing-object-spec" (a **drawing-object** or a list) which can then be displayed by inclusion in the hierarchy under an **objects-displayer** (potentially via a **pinboard-objects-displayer**).

The functions are geared towards producing graphs of (mathematical) functions and bar charts. The function **generate-grid-lines** is used to generate grid of lines. The function **generate-labels** is used to generate labels, with the intention that these labels will match the grid lines.

The functions **generate-graph-from-pairs** and **generate-graph-from-graph-spec** are used to generate the actual graph. The graph is actually a sequence of straight lines connecting consecutive points (neighbouring points in the x dimension), but by giving it enough points the graph can be made to look smooth. Currently there is no smoothing option.

**generate-graph-from-pairs** receives the points as a list of lists (x y). **generate-graph-from-graph-spec** takes a **basic-graph-spec** which you make by calling **make-basic-graph-spec**. The graph spec contains a function which computes the y value corresponding to the supplied x value, and information (start, step and range) which specifies the x values to use. The **basic-graph-spec** is intended to simplify writing code that repeatedly draws graphs with similar attributes.

**generate-bar-chart** generates the bars of a bar chart, with an optional title for each bar.

To show something useful, you will normally combine the results of **generate-grid-lines**, **generate-labels** and one of **generate-graph-from-pairs**, **generate-graph-from-graph-spec** or **generate-bar-chart** (typically by just using cl:list), and then position and scale the result using the geometry functions (**position-object**, **fit-object**, **position-and-fit-object**), and the result of this will be put into a hierarchy under an **objects-displayer** or **pinboard-objects-displayer**.
Note that when you scale (using `fit-object` or `position-and-fit-object`), you effectively change the units of drawing inside the scaled object. You can therefore generate the graph in its natural coordinates, and then put in the correct dimensions on the screen. The example below generates a graph with size of 18x9, and then uses `fit-object` with the same width and height, which scales the graph to fit the full area that it is supplied. We also give it some margin using `position-object`.

We then use the result (fitted-graph-with-margin) both as the `drawing-object` of a `pinboard-objects-displayer` and the `drawing-object` of an `objects-displayer` which also contains the `pinboard-objects-displayer`. In the `pinboard-objects-displayer` we also add a red rectangle to show the area of the `pinboard-objects-displayer`. The result is that the same graph is displayed twice: once inside `pinboard-objects-displayer` and once inside the whole `objects-displayer`. If you resize the window, you see that the outer graph resizes, while the inner graph stays the same (because the `pinboard-objects-displayer` does not change size).
(let* ((graph
   (lw-gt:generate-grid-lines
    :horizontal-count 18
    :vertical-count 9
    :right-thickness 3
    :major-x-step 4
    :major-y-step 3
    :thickness 1
    :major-thickness 2
    :major-color :blue
    :color :green))
  (fitted-graph (lw-gt:fit-object graph 18 9))
  (fitted-graph-with-margin
   (lw-gt:position-object fitted-graph
    :left-margin 10
    :right-margin 10
    :top-margin 10
    :bottom-margin 10))
  (red-rectangle
   (lw-gt:fit-object
    (lw-gt:make-draw-rectangle 0 0 1 1
     :foreground :red
     :thickness 2
     :scale-thickness nil)
    1 1))
  (pinboard-object (lw-gt:make-pinboard-objects-displayer
    (list red-rectangle fitted-graph-with-
     margin)
    :x 45 :y 45 :width 400 :height 400)))
  (setq *pane* (capi:contain (make-instance 'lw-gt::objects-
    displayer
    :description (list pinboard-object)
    :drawing-object fitted-graph-with-
     margin)
    :best-width 500 :best-height 500)))

For the pinboard-object to resize, you need to resize it explicitly.

The following function moves the first pinboard object:

(defun move-first-pinboard-object (pane x y width height)
  (capi:apply-in-pane-process
   pane
   #'(lambda (pane x y width height)
     (let ((po (car (capi:layout-description pane))))
       (setf (capi:static-layout-child-geometry po)
         (values x y width height))))
   pane x y width height))
Now this moves the pinboard object, and resizes the grid inside it (as well as the red rectangle):

```
(move-first-pinboard-object *pane* 20 60 420 300)
```

More extended are examples are in

```
(example-edit-file "graphic-tools/bar-chart-example")
(example-edit-file "graphic-tools/graph-example")
```
Graphic Tools drawing objects
15

The Color System

15.1 Introduction

The LispWorks Color System allows applications to use keyword symbols as aliases for colors in Graphics Ports drawing functions. They can also be used for backgrounds and foregrounds of windows and CAPI objects.

For example, the call

```
(gp:draw-line my-port x1 y1 x2 y2
   :foreground :navyblue)
```

uses the keyword symbol `:navyblue` for the color of the line.

Colors are looked up in a color database. The LispWorks image is delivered with a large color database already loaded (approximately 660 entries.) The color database contains color-specs which define the colors in terms of a standard color model. When the drawing function is executed, the color-spec is converted into a colormap index (or “pixel” value).

The LispWorks Color System has facilities for:

- Defining new color aliases in one of several color models.
- Loading the color database from a file of color descriptions.
- Converting color specifications between color models.
15 The Color System

• Defining new color models.

It is accessible from the color package, and all symbols mentioned in this chapter are assumed to be external to this package unless otherwise stated. You can qualify them all explicitly in your code, for example `apropos-color-names`.

However it is more convenient to create a package which has the color package on its package-use-list:

```lisp
(defunpackage "MY-PACKAGE"
  (:add-use-defaults t)
  (:use "COLOR" "CAPI")
)
```

This creates a package in which all the color symbols (and for convenience, capi as well) are accessible. To run the examples in this chapter, evaluate the form above and then:

```lisp
(in-package "MY-PACKAGE")
```

The color-models available by default are RGB, HSV and GRAY.

15.1.1 Rendering of colors

Some colors do not render exactly as expected in some CAPI classes such as title-pane - it depends on the palette provided by the rendering system.

However, output-pane and its subclasses support non-standard palettes.

15.2 Reading the color database

To find out what colors are defined in the color database, use the function `apropos-color-names`. For example:

```lisp
(apropos-color-names "RED") =>
(:ORANGERED3 :ORANGERED1 :INDIANRED3 :INDIANRED1
 :PALEVIOLETRED :RED :INDIANRED :INDIANRED2
 :INDIANRED4 :ORANGERED :MEDIUMVIOLETRED
 :VIOLETRED :ORANGERED2 :ORANGERED4 :RED1 :RED2 :RED3
 :RED4 :PALEVIOLETRED1 :PALEVIOLETRED2 :PALEVIOLETRED3
 :PALEVIOLETRED4 :VIOLETRED3 :VIOLETRED1 :VIOLETRED2
 :VIOLETRED4)
```
For information about only aliases or only original entries, use `apropos-color-alias-names` or `apropos-color-spec-names` respectively.

To get a list of all color names in the color database, call `get-all-color-names`.

### 15.3 Color specs

A color spec is an object which numerically defines a color in some color-model. For example the object returned by the call:

```
(color:make-rgb 0.0 1.0 0.0) =>
#(,:RGB 0.0 1.0 0.0)
```

defines the color green in the RGB color model. Generally short-floats are used; this results in the most efficient color conversion process. However, any float type can be used.

To find out what color-spec is associated with a color name, use the function `get-color-spec`. It returns the color-spec associated with a symbol. If there is no color-spec associated with `color-name`, this function returns `nil`. If `color-name` is the name of a color alias, the color alias is dereferenced until a color-spec is found.

Color-specs are made using standard functions `make-rgb`, `make-hsv` and `make-gray`. For example:

```
(make-rgb 0.0s0 1.0s0 0.0s0)
(make-hsv 1.2s0 0.5s0 0.9s0)
(make-gray 0.66667s0)
```

To create a color spec with an alpha component using the above constructors, pass an extra optional argument. For example this specifies green with 40% transparency:

```
(make-rgb 0.0s0 1.0s0 0.0s0 0.6s0)
```

You can also make a transparent color using `color-with-alpha`:

```
(color-with-alpha color-spec 0.8s0)
```

Note that the alpha component is not supported on Motif.
The predicate `color-spec-p` can be used to test for color-spec objects. The function `color-model` returns the model in which a color-spec object has been defined.

### 15.4 Color models

Three color models are defined by default: RGB, HSV and GRAY. RGB and HSV allow specification of any color within conventional color space using three orthogonal coordinate axes, while gray restricts colors to one hue between white and black. All color models contain an optional alpha component, though this is used only on Cocoa and Windows.

<table>
<thead>
<tr>
<th>Model</th>
<th>Name</th>
<th>Component: Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGB</td>
<td>Red Green Blue</td>
<td>RED (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GREEN (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BLUE (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALPHA (0.0 to 1.0)</td>
</tr>
<tr>
<td>HSV</td>
<td>Hue Saturation</td>
<td>HUE (0.0 to 5.99999)</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>SATURATION (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VALUE (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALPHA (0.0 to 1.0)</td>
</tr>
<tr>
<td>GRAY</td>
<td>Gray</td>
<td>GRAY (0.0 to 1.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALPHA (0.0 to 1.0)</td>
</tr>
</tbody>
</table>

The Hue value in HSV is mathematically in the open interval [0.0 6.0). All values must be specified in floating point values.

You can convert color-specs between models using the available `ensure-<model>` functions. For example:
Of course, information can be lost when converting to GRAY:

```
(make-rgb 0.3 0.4 0.5) => #:RGB 0.3 0.4 0.5
(ensure-gray (make-rgb 0.3 0.4 0.5))
  => #:GRAY 0.39999965
(ensure-rgb (ensure-gray
  (make-rgb 0.3 0.4 0.5)))
  => #:RGB 0.39999965 0.39999965 0.39999965
```

There is also `ensure-color` which takes two color-spec arguments. It converts if necessary the first argument to the same model as the second. For example:

```
(ensure-color (make-gray 0.3) green)
  => #:RGB 0.3 0.3 0.3
```

`ensure-model-color` takes a model as the second argument. For example:

```
(ensure-model-color (make-gray 0.3) :hsv)
  => #:HSV 0 1.0 0.3
```

The function `colors=` compares two color-spec objects for color equality.

The function `color-level` returns the gray level of a color-spec, and the functions `color-blue`, `color-green`, `color-red`, `color-hue`, `color-saturation` and `color-value` return the associated components.

The color models above represent the color in a portable (and externalizable) way. To actually use it, the system needs to convert to the representation used by the underlying display system. The user can do the conversion using `convert-color`. The result is called a "converted color" or "color representation" or "color-rep", and is more efficient to use in drawing functions, because it saves the system from doing the conversion each time it uses the color.
15.5 Color aliases

You can enter a color alias in the color database using the function `define-color-alias`. You can remove an entry in the color database using `delete-color-translation`.

`define-color-alias` makes an entry in the color database under a name, which should be a symbol. LispWorks by convention uses keyword symbols. The name points to either a color-spec or another color name (symbol):

```
(define-color-alias :wire-color :darkslategray)
```

Attempting to replace an existing color-spec in the color database results in an error. By default, replacement of existing aliases is allowed but there is an option to control this (see the manual page for `define-color-alias`).

`delete-color-translation` removes an entry from the color-database. Both original entries and aliases can be removed:

```
(delete-color-translation :wire-color)
```

As described in Section 15.3 on page 243, the function `get-color-spec` returns the color-spec associated with a color alias. The function `get-color-alias-translation` returns the ultimate color name for an alias:

```
(define-color-alias :lispworks-blue (make-rgb 0.70s0 0.90s0 0.99s0))
(define-color-alias :color-background :lispworks-blue)
(define-color-alias :listener-background :color-background)

(get-color-alias-translation :listener-background) => :lispworks-blue
(get-color-alias-translation :color-background) => :lispworks-blue
```

There is a system-defined color alias `:transparent` which is useful when specified as the `background` of a pane. It is currently supported only on Cocoa. For example:
15.6 Loading the color database

You can load new color definitions into the color database using `read-color-db` and `load-color-database`.

Given a color definition file `my-colors.db` of lines like these:

```
#: (:RGB 1.0s0 0.980391s0 0.980391s0) snow
#: (:RGB 0.972548s0 0.972548s0 1.0s0) GhostWhite
```

call

```
(load-color-database (read-color-db "my-colors.db"))
```

The color database is stored in the variable `*color-database*`. To clear the database use the form:

```
(setf *color-database* (make-color-db))
```

Note: You should do this before starting the LispWorks IDE (that is, before `env:start-environment` is called) or before your application’s GUI starts. Be sure to load new color definitions for all the colors used in the GUI. The initial colors were obtained from the `config/colors.db` file.

You can remove a color database entry with `delete-color-translation`.

15.7 Defining new color models

Before using the definition described here, you should evaluate the form:

```
(require "color-defmodel")
```

The macro `define-color-models` can be used to define new color models for use in the color system.
The default color models are defined by the following form:

\[
\text{(define-color-models ((\text{rgb} (red 0.0 1.0) } \\
\text{ (green 0.0 1.0) } \\
\text{ (blue 0.0 1.0)))} \\
\text{ (:hsv (hue 0.0 5.999999) } \\
\text{ (saturation 0.0 1.0) } \\
\text{ (value 0.0 1.0)) } \\
\text{ (:gray (level 0.0 1.0))))}
\]

For example, to define a new color model YMC and keep the existing RGB, HSV and GRAY models:

\[
\text{(define-color-models ((\text{rgb} (red 0.0 1.0) } \\
\text{ (green 0.0 1.0) } \\
\text{ (blue 0.0 1.0)))} \\
\text{ (:hsv (hue 0.0 5.999999) } \\
\text{ (saturation 0.0 1.0) } \\
\text{ (value 0.0 1.0)) } \\
\text{ (:gray (level 0.0 1.0)))} \\
\text{ (:ymc (yellow 0.0 1.0) } \\
\text{ (magenta 0.0 1.0) } \\
\text{ (cyan 0.0 1.0))))}
\]

You must then define some functions to convert YMC color-specs to other color-specs. In this example, those functions are named

- make-ymc-from-rgb
- make-ymc-from-hsv
- make-ymc-from-gray

and

- make-rgb-from-ymc
- make-hsv-from-ymc
- make-gray-from-ymc

You can make this easier, of course, by defining the functions

- make-ymc-from-hsv
- make-ymc-from-gray
- make-hsv-from-ymc
- make-gray-from-ymc

in terms of make-ymc-from-rgb and make-rgb-from-ymc.

If you never convert between YMC and any other model, you need only define the function make-rgb-from-ymc.
The CAPI hardcopy API is a mechanism for printing a Graphics Port (and hence a CAPI output-pane) to a printer. It is arranged in a hierarchy of concepts: printers, print jobs, pagination and outputting.

Printers correspond to the hardware accessible to the OS. Print jobs control connection to a printer and any printer-specific initialization. Pagination controls the number of pages and which output appears on which page. Outputting is the operation of drawing to a page. This is accomplished using the standard Graphics Ports drawing functions discussed in Chapter 13, “Drawing - Graphics Ports”.

Printing is done by using the macro with-print-job to define a job. Inside its body you specify pages to print by either with-document-pages ("page on demand printing") or with-page ("page sequential printing"). Inside the body of with-document-pages or with-page you use normal drawing functions on the variable bound by with-print-job to draw the page. You normally also use with-page-transform to specify the transformation to the page area. There are also several functions for simple printing jobs.

16.1 Printers

You can obtain the current printer, or ask the user to select one, by using current-printer. You can ask the user about configuration by using the func-
tions page-setup-dialog and print-dialog which display the standard Page Setup and Print dialogs.

You can pass the printer object (as returned by current-printer or print-dialog) to APIs with a printer argument, such as with-print-job, page-setup-dialog and print-dialog. The printer object itself is opaque but you can modify the configuration programmatically using set-printer-options.

16.1.1 Standard shortcut keys in printer dialogs

On Cocoa by default the standard shortcuts Command+P and Command+Shift+P invoke Print... and Page Setup... menu commands respectively. In Microsoft Windows editor emulation by default the standard shortcut Ctrl+P invokes a Print... menu command.

16.2 Print jobs

A Print job is contained within a use of the macro with-print-job, which handles connection to the printer and sets up a graphics port for drawing to the printer.

16.3 Handling pages—page on demand printing

In Page on Demand Printing, the application provides code to output an arbitrary page. The application should be prepared to print pages in any order. This is the preferred means of implementing printing. Page on Demand printing uses the with-document-pages macro, which executes the code for each page to be printed, in an unspecified order.

16.4 Handling pages—page sequential printing

Page Sequential Printing may be used when it is inconvenient for the application to implement Page on Demand printing. In Page Sequential Printing, the application outputs each page of the document in order. Page Sequential printing is done by using the with-page macro, with each invocation of with-page contributing a new page to the document.
Note: with-page does not work on Cocoa.

16.5 Printing a page

In either mode of printing, the way in which a page is printed is the same. A suitable transformation must be established between the coordinate system of the output-pane or printer-port object and the physical page being printed. The page is then drawn using normal Graphics Ports operations, which are described in Chapter 13, “Drawing - Graphics Ports”.

16.5.1 Establishing a page transform

The with-page-transform macro can be used to establish a page transform which controls scaling by mapping a rectangular region of the document to the printable area of the page. The scale matches the screen by default. By specifying a large rectangle, you can get finer granularity in the drawing. Any number of invocations of with-page-transform may occur during the printing of a page. For instance, it may be convenient to use a different page transform when printing headers and footers to the page from that used when printing the main body of the page.

A helper function, get-page-area, is provided to simplify the calculation of suitable rectangles for use with with-page-transform. It calculates the width and height of the rectangle in the user’s coordinate space that correspond to one printable page, based on the logical resolution of the user’s coordinate space in dpi.

For more specific control over the page transform, the printer metrics can be queried using get-printer-metrics and the various printer-metrics accessors such as printer-metrics-height.

Margins and the printable area can be set using set-printer-metrics.

There is an example in:

(example-edit-file "capi/printing/fit-to-page")
16.6 Other printing functions

To add, remove and configure printers on platforms other than Motif use the system configuration utility. On Microsoft Windows this is the Printer Control Panel. On Cocoa printers are configured via the System Preferences.

A simple printing API is available via simple-print-port, which prints the contents of an output-pane to a printer.

The Hardcopy API also allows you to print plain text to a printer. To do this, use the functions print-text, print-file and print-editor-buffer, and the macro with-output-to-printer.

16.7 Printing on Motif

This section applies only to X11/Motif, where the hardcopy API uses Postscript rather than native printing.

16.7.1 Printer definition files

On Motif, CAPI uses its own printer definition files to keep information about printers. These files contain a few configuration settings, and the name of the PPD file if applicable (see “PPD files” on page 252 for information about PPD files). When a user saves a printer configuration, the system writes such a file. Note that because the printer definition file contains the name of the PPD file, it must only be moved between machines with care: the PPD file must exist in the same path.

Printer definition files are loaded from directories in the value of *printer-search-path*.

16.7.2 PPD files

To fully use the functionality of a Postscript printer on Motif, the system needs a Postscript Printer Description (PPD) file, which is a file in a standard format defined by Adobe. It describes the options the printer has and how to control them.
When a print dialog is presented to the user (either by an explicit call to `print-dialog`, or by printing), the system uses the PPD file to find what additional options to present, and how to communicate them to the printer.

A PPD file should be supplied by the manufacturer with the printer itself. Otherwise, it is normally possible to obtain the PPD file from the website of the manufacturer. The name of a PPD file should be `printername.ppd`.

When the user configures a new printer, the first thing the system does is to show the user all the PPD files that it can find under the `*ppd-directory*` (directly, or one level of directories below it). The application should set this variable to the appropriate directory.

If the value of `*ppd-directory*` is `nil`, the system looks at the directory obtained by evaluating `(sys:lispworks-dir "postscript/ppd")`.

If the printer does not have a PPD file, the user can still use it by selecting the default button in the print dialog. This means that the system will let the user change only the basic properties of the printer, without using its more complex features.

### 16.7.3 Adding and removing printers

On Motif, printers can be added, removed and configured interactively via `printer-configuration-dialog`. Printers can be added and removed programmatically with `install-postscript-printer` and `uninstall-postscript-printer`.
This chapter discusses how to implement drag and drop functionality in your CAPI application. The example code in this chapter forms a complete example allowing the user to drag an item from a tree-view to a list-panel.

17.1 Overview of drag and drop

A drag and drop operation occurs when the user clicks and holds the mouse button in a pane supporting dragging, then drags to a pane supporting dropping, and releases the mouse button.

Visual feedback may be provided indicating that dragging is happening, whether a drop operation is possible at the current mouse position, and what operation will occur when the user drops. Usually the operation is the transfer of data.

You need to decide which CAPI pane(s) and interfaces will support dragging and then implement it for each, and similarly for dropping. You will implement drag and drop for one or more specified data formats.
17.1.1 Drag and drop with other applications

Certain predefined data formats can be dragged from a CAPI application to another application such as the Windows Explorer or the Mac OS X Finder, and vice versa.

17.1.2 Drag and drop within a CAPI application

When both the drag and the drop phases are within the same CAPI image, you can specify private data formats, in addition to the predefined data formats.

17.2 Dragging

First you should decide which CAPI pane(s) and interfaces will support dragging, and which data formats they will support. Data formats are arbitrary keywords that must be interpreted by the pane where the user can drop.

17.2.1 Dragging values from a choice

To implement dragging in list-panel or tree-view supply the :drag-callback initarg. When the user drags, drag-callback receives a list of indices of the choice items being dragged.

The drag-callback should return a property list whose keys are the data formats (such as :string or :image) to be dragged, along with the values associated with each format.

17.2.1.1 Example: dragging from a tree

This example returns string data for a tree-view defined below:
(defun tree-drag-callback (pane indices)
  (list :string
        (string (elt (capi:collection-items pane)
                    (first indices))))

(defun fruits (x)
  (case x
    (:fruits (list :apple :orange))
    (:apple (list :cox :bramley))
    (:orange (list :blood-orange :seville))
    (t nil)))

(capi:contain (make-instance 'capi:tree-view
                           :title "Fruit tree"
                           :roots '(:fruits)
                           :children-function 'fruits
                           :drag-callback 'tree-drag-callback))

There is a further example showing dragging from list-panels in

(example-edit-file "capi/choice/drag-and-drop")

17.2.2 Dragging within an output-pane
To implement dragging items around within a single output-pane, include suitable callbacks on these gestures in its input-model:

(:button-1 :press)
(:button-1 :motion)

In this case it is not necessary to call drag-pane-object and you can implement dropping in the same pane by a suitable callback for:

(:button-1 :release)

See this example:

(example-edit-file "capi/applications/balloons")

17.2.3 Dragging values from an output-pane
To implement dragging from an output-pane include an appropriate callback on the (:button-1 :press) gesture in the pane’s input-model. This callback should call drag-pane-object with arguments which provide the data for-
mats and values associated with each format. You will also specify drop-callback in the destination pane(s), as described in “Dropping” on page 259.

See the example file in

```
(example-edit-file "capi/output-panes/drag-and-drop")
```

### 17.2.3.1 Dragging editor-pane text

To implement dragging of text in an editor-pane, use EDITOR functions such as `editor:points-to-string` to obtain the value for the `:string` format.

### 17.2.4 Data formats

- **`:string`**
  Receives a string, potentially from another application. Is also understood by some other panes that expect text.

- **`:image`**
  Receives an image on Cocoa and GTK+. The value passed should be an `image` object. See “Working with images” on page 219 for more information about images. When supplying an image for dragging (that is, including `image image` in the plist argument of `drag-pane-object` or in the plist that is returned from the `drop-callback`), the dragging mechanism frees the image (as by `free-image`) when it finishes with it (which will be at some indeterminate time later). If you need to pass an image which you want to use later, you should make a copy of it by `make-sub-image`.
  
  When receiving an image (by calling `drop-object-get-object` with `:image`), the received image should also be freed when you finish with it. However, it will be freed automatically when the pane supplied to `drop-object-get-object` is destroyed, so you do not need to free it explicitly if freeing can wait (which is probably true in most cases).

See this example:

```
(example-edit-file "capi/choice/list-panel-drag-image")
```
17.3 Dropping

:filename-list

Receives a list of files. Is understood by other applications such as the Mac OS X Finder and Windows Explorer.

You can also use private formats, named by arbitrary keywords, which will work only in the same Lisp image.

17.2.5 Dragging a Cocoa title bar image

On Cocoa, if there is a drag image in an interface title bar, then dragging this image will by default return a list containing the interface pathname as :filename-list data. You could override this by providing a drag-callback for the interface.

17.3 Dropping

First you should decide which CAPI pane(s) and interfaces will support dropping, where exactly dropping should be allowed, and what should occur on dropping for each data format that is made available.

17.3.1 The drop callback

To implement dropping in list-panel or tree-view or output-pane, supply the :drop-callback initarg.

You can also supply :drop-callback for an interface. When the user drags an object over a window, the system first tries to call the drop-callback of any pane under the mouse and otherwise calls the drop-callback of the top-level interface, if supplied.

The drop-callback receives as arguments a drop-object which is used to communicate information about the dropping operation and stage which is a keyword. The drop-callback is called at several stages: when the pane is displayed; when the user drags over the pane; and when the user drops over the pane. Various functions are provided which you can use to query the drop-object and set attributes appropriately.

You will use set-drop-object-supported-formats to specify the data formats that it wants to receive. The :string format can be used to receive a
string from another application and the \texttt{filename-list} format can be used to receive a list of filenames from another application such as the Macintosh Finder or the Windows Explorer. Any other keyword in formats is assumed to be a private format that can only be used to receive objects from within the same Lisp image.

You can use \texttt{drop-object-provides-format} to query whether a given data format is actually available, and then you can call \texttt{(setf drop-object-drop-effect)} to modify the effect of the dropping operation.

Finally, at the \texttt{:drop} stage, you will use \texttt{drop-object-get-object} to retrieve (for each data format) the object which was returned by the \texttt{drag-callback}, and then do something with this object, typically copying or moving it to the pane in some way.

17.3.2 Dropping in a choice

Additionally within the \texttt{drop-callback} of a \texttt{list-panel} or \texttt{tree-view} you can use \texttt{drop-object-collection-index} (or \texttt{drop-object-collection-item}) to query the index (or item) where the object would currently be dropped.

17.3.2.1 Example: dropping in a list

This \texttt{drop-callback} simply appends the dropped string at the end of the list:
(defun list-drop-callback (pane drop-object stage)
  (format t "list drop callback ~S ~S ~S" pane drop-object stage)
  (case stage
    (:formats
      (set-drop-object-supported-formats drop-object
        (list :string)))
    (:enter :drag)
      (when (and (drop-object-provides-format drop-object :string)
        (drop-object-allows-drop-effect-p drop-object :copy))
        (setf (drop-object-drop-effect drop-object) :copy))
    (:drop
      (when (and (drop-object-provides-format drop-object :string)
        (drop-object-allows-drop-effect-p drop-object :copy))
        (setf (drop-object-drop-effect drop-object) :copy)
        (add-list-item pane drop-object)))
  ))

(defun add-list-item (pane drop-object)
  (append-items
    pane
    (list (string-capitalize
      (drop-object-get-object drop-object
        pane :string)))))

(contain
  (make-instance 'list-panel
    :title "Shopping list"
    :items (list "Tea" "Bread"
    :drop-callback 'list-drop-callback))

Try dragging an item from the tree-view created in “Example: dragging from a tree” on page 256.

Below is a more sophisticated version of add-list-item which inserts the item at the expected position within the list. This position is obtained using drop-object-collection-index:
(defun add-list-item (pane drop-object)
  (multiple-value-bind (index placement)
      (drop-object-collection-index drop-object)
    (list-panel-add-item pane
      (string-capitalize
       (drop-object-get-object
        drop-object pane :string))
      index placement))))

(defun list-panel-add-item (pane item index placement)
  (let ((item-count (count-collection-items pane)))
    (let ((adjusted-index (if (eq placement :above)
                               index
                               (1+ index)))
      (current-items (collection-items pane)))
    (setf (collection-items pane)
      (concatenate 'simple-vector
        (subseq current-items 0 adjusted-index)
        (vector item)
        (subseq current-items adjusted-index
          item-count))))))

17.3.3 Dropping text in an editor-pane

Supply the special drop-callback :default to implement dropping text in an editor-pane.

17.3.4 Dropping in an output-pane

Additionally within the drop-callback of an output-pane, you can use drop-object-pane-x and drop-object-pane-y to query the coordinates in the pane that the object is being dropped over.

17.4 Limitations of CAPI drag and drop

:image format currently works fully only on Cocoa and GTK+. On Microsoft Windows the :image format works only when dragging between panes in the same process.

Drag and drop is not implemented in CAPI on Motif.

Not all pane classes support drag and drop.
This chapter discusses miscellaneous functionality available for use during development and in your CAPI application.

18.1 Development functions
The following functions are intended as aids during development. In general they are not suitable for use in real applications, though they are fully supported.

The function `contain` takes an element argument and displays it. The element can be any pane, menu or a part of a menu, or a pinboard-object. Since displaying always requires an interface, `contain` creates an interface (unless the element is an `interface` itself). `contain` takes various keyword arguments that tell it how to display, and can also display the element as a dialog.

To create the interface, `contain` uses `make-container`, which can also be called directly.
18.2 Sounds

18.2.1 Sound API
This section applies to Cocoa and Microsoft Windows only.

On Cocoa and Microsoft Windows, CAPI provides a simple interface to play sound from sound files. The host system determines which formats of sound files it can play.

Use \texttt{load-sound} to create a sound object from either a file or the result of \texttt{read-sound-file}, then \texttt{play-sound} to play it, and \texttt{stop-sound} to stop playing. \texttt{free-sound} can be used to free it.

\texttt{read-sound-file} can be used to load a sound file as data into the Lisp image, which then can be used by \texttt{load-sound} without accessing a file. This is useful in delivered applications.

18.2.2 Beep
The function \texttt{beep-pane} tries to make a beep sound.

18.3 Modifier keys state
You can query the state of the modifier keys (\texttt{Control}, \texttt{Shift}, \texttt{Meta}, \texttt{Command} (\texttt{Hyper}) and \texttt{Caps Lock}) by calling \texttt{pane-modifiers-state}.

18.4 Restoring display while debugging
Some error handlers may disable display of a pane if there is an error during the display. You can check if a pane is in this state by calling \texttt{pane-can-restore-display-p}, and if so you can use \texttt{pane-restore-display} to restore the display. That assumes that the code was fixed, so is useful only while debugging.

The Window Browser tool in the LispWorks IDE allows you to restore the display interactively using these functions.
18.5 Object properties and name

All CAPI elements (panes and pinboard-object) inherit from capi-object. This includes a plist, which can be accessed by capi-object-property, (setf capi-object-property) and remove-capi-object-property. There is also the accessor capi-object-plist.

CAPI object property is a very convenient mechanism to add slot-like behavior without having to define your own class. For example, it is used for caching the images in

```lisp
(exexample-edit-file "capi/choice/list-panel-drag-images")
```

A capi-object also has a name, which can be used to give it a unique identifier. You can set name by the initarg :name, and access it by capi-object-name.

18.6 Clipboard

You can access the system clipboard, which allows passing and receiving values from other processes, by the functions clipboard and set-clipboard. These can deal with strings and images, and metafiles on Cocoa and Microsoft Windows. When used inside the same Lisp process, they can also be used to pass Lisp values. Use clipboard-empty to check if there is anything in the clipboard. See also “Edit actions on the active element” on page 104.

Similarly, the primary selection of the GUI system can accessed by the function selection, set-selection and selection-empty.

18.7 Handles

The function simple-pane-handle can be used to retrieve the "handle" of a displayed pane. Similarly current-dialog-handle returns the handle of the current dialog, if there is one.

The handle is the representation in the underlying GUI system, and may be useful in some situations for performing operations for which there is no CAPI interface.
This chapter describes how the host window system affects the appearance and behavior of CAPI windows, and how to configure this.

19.1 Microsoft Windows-specific issues

19.1.1 Using Windows themes
On Microsoft Windows Vista, Windows 7 and Windows 8 LispWorks is themed. That is, it uses the current theme of the desktop.

It is possible to switch this off by calling the function `win32:set-application-themed` with argument `nil`.

`win32:set-application-themed` affects only windows that are created after it was called. Normally, it should be called before any window is created, so that all LispWorks windows will have a consistent appearance.

19.1.2 The break gesture
If a CAPI/Windows window is busy and unresponsive you can use the break gesture `Ctrl+Break` to regain control.
19.2 Cocoa-specific issues

19.2.1 The break gesture

If a CAPI/Cocoa window is busy and unresponsive you can use the break gesture `Command+Ctrl+,` (comma) to regain control.

19.2.2 The Cocoa application interface

You can use `set-application-interface` on an instance of a subclass of `cocoa-default-application-interface` to get the following functionality:

- Define the application menu (leftmost menu in the menu bar).
- Define the menu bar items that are displayed when no interface is on the screen.
- Define the Dock context menu, which is raised from the Dock icon.
- Control and callbacks about the lifecycle of the interface.

A proper Cocoa application is likely to use this mechanism. Note that the call to `set-application-interface` needs to happen before any display or attempt to access the screen. See `cocoa-default-application-interface` for more details.

19.3 GTK+-specific issues

19.3.1 The break gesture

If a CAPI/GTK+ window is busy and unresponsive you can use the break gesture `Meta+Ctrl+C` to regain control.

On GTK+ you can use the function `set-interactive-break-gestures` both to find and to set the keys that are used interactively as break gestures. When the system detects a break gesture it tries to interrupt any running process, to allow the user to deal with runaway processes.
19.3.2 Matching resources for GTK+

You can configure the LispWorks IDE and your application to use resources on GTK+. The applicable resources determine the default fonts, colors and certain other properties used in CAPI elements.

The element initarg widget-name is used to match resources. CAPI gives a name for the main widget that it creates for each element that has a representation in the library. This name is then included in the "path" that GTK+ uses to match resources for each widget.

19.3.2.1 Resources on GTK+

By default, the name of the widget is the name of the class of the element, downcased (except top level interfaces, see next paragraph). You can override the name by either passing widget-name when making the element, or by calling (setf element-widget-name) before displaying the element.

To make it easier to define resources specific to the application, the CAPI GTK+ library, when using the default name, prepends the application-class (see convert-to-screen) followed by a dot. So for an interface of class my-interface which is displayed in a screen with application-class "my-application", the default widget-name is:

```
my-application.my-interface
```

Example GTK+ resource files are in your LispWorks installation directory under examples/gtk/:

```
gtkrc-break-gestures
gtkrc-font
gtkrc-parameters
gtkrc-styles
```

19.3.2.2 Resources for CAPI/GTK+ applications

Delivered applications which need fallback resources should pass the :application-class and :fallback-resources keys described in the manual page for convert-to-screen.
This example shows how to make a CAPI GUI configurable by GTK+ resources:

\[
\text{(example-edit-file "capi/elements/gtk-resources")}
\]

To construct custom resources for your CAPI/GTK+ application, see the example resource files in your LispWorks installation directory under \texttt{examples/gtk/}.

**19.3.2.3 X resources for in-place completion windows**

The special window described in “In-place completion” on page 168 has interface with name \texttt{"non-focus-list-prompter"}. This name can be used to define resources specific to the in-place completion window. The completion list is a \texttt{list-panel} and the filter is a \texttt{text-input-pane}.

**19.4 Motif-specific issues**

**19.4.1 Using Motif**

The Motif backend is deprecated and the GTK+ backend is preferred.

This section describes how to use the Motif window system on supported platforms.

**19.4.1.1 Using Motif on Linux, FreeBSD, AIX and x86/x64 Solaris**

Use of Motif with LispWorks is deprecated on these platforms, but you can still use it.

LispWorks uses GTK+ as the default window system for CAPI and the LispWorks IDE on Linux, FreeBSD, AIX and x86/x64 Solaris.

To use Motif instead you need to load it explicitly, by:

\[
\text{(require "capi-motif")}
\]

Requiring the \texttt{"capi-motif"} module makes CAPI use Motif as its default library.
You can override the default library by specifying the appropriate CAPI screen (see “CAPI communication with host window system - libraries” on page 272 and the \texttt{screen} argument to \texttt{display} and \texttt{convert-to-screen}).

19.4.1.2 Using Motif on Macintosh

Use of Motif with LispWorks is deprecated on the Macintosh, but you can still use it.

LispWorks is supplied as two images. One uses Cocoa as the default window system for CAPI and the LispWorks IDE, the other uses GTK+ as its default window system. Only this latter image can use the alternative Motif window system.

To use Motif you need to load it into the GTK+ LispWorks image, by:

\begin{verbatim}
(require "capi-motif")
\end{verbatim}

Requiring the \texttt{"capi-motif"} module makes CAPI use Motif as its default library.

You can override the default library by specifying the appropriate CAPI screen (see “CAPI communication with host window system - libraries” on page 272 and the \texttt{screen} argument to \texttt{display} and \texttt{convert-to-screen}).

\textbf{Note:} you cannot load Motif into the Cocoa image.

\textbf{Note:} the GTK+ LispWorks image is installed on Macintosh when you select the X11 GUI option at install time. See the \textit{LispWorks Release Notes and Installation Guide} for further information on installing this option.

19.4.1.3 Using Motif on SPARC Solaris

LispWorks on SPARC Solaris does not support GTK+, and Motif is the only supported window system. You do not need to load it or specify the \texttt{screen} explicitly on these platforms.

19.4.2 The break gesture

If a CAPI/Motif window is busy and unresponsive you can use the break gesture \texttt{Meta+Ctrl+C} to regain control.
19.4.3 Matching resources for X11/Motif

On Motif, you can configure the LispWorks IDE and your application to use resources similarly to GTK+ (see “Matching resources for GTK+” on page 269).

19.4.3.1 Resources on X11/Motif

widget-name is used as described for GTK+ in “Resources on GTK+” on page 269, except that the default widget-name for a top level interface does include the prepended application-class.

The file app-defaults/Lispworks, supplied in the LispWorks library for relevant platforms, contains the application fallback resources for LispWorks 7.0 and illustrates resources you may wish to change.

The file app-defaults/GcMonitor contains the application fallback resources for the Lisp Monitor window.

The files app-defaults/*-classic contain the fallback resources that were supplied with LispWorks 4.4.

For further information about X resources, consult documentation for the X Window system.

19.4.3.2 Resources for CAPI/Motif applications

To construct custom X resources for your CAPI/Motif application, consult app-defaults/Lispworks which illustrates resources you may wish to change in your application.

19.5 CAPI communication with host window system -
19.5  CAPI communication with host window system - libraries

CAPI communicates with the host window system via backends called libraries. In most cases you need not worry about the library, and just use generic CAPI.

Currently there are four libraries, named by keywords as follows:

- **:win32** The only library for Microsoft Windows.
- **:cocoa** The default library for Mac OS X.
- **:gtk** The default library for most Unix platforms, also available on Mac OS X.
- **:motif** Deprecated but available on most Unix platforms. The only library for SPARC Solaris.

The function `default-library` returns the default library for the current platform.

**Note:** On platforms that support GTK+ and Motif, `default-library` normally returns :gtk, but after loading Motif using `(require "capi-motif")` it returns :motif.

A library name is a valid argument to `convert-to-screen`, and can be used in places when a screen specification is required, most importantly as argument to `display`. Normally, however, you will be using the default screen of the default library, so you will not have to worry about it.

`default-library` is used when a program that is designed to run on various platforms wants to do different things in different GUI systems. Note that `default-library` is available before displaying anything, and can be used at load-time.

The functions `installed-libraries` returns a list of the installed libraries in the current image. Normally it is just a list of the default library, but loading Motif adds it into the list.
Host Window System-specific issues
This chapter enumerates the set of CAPI examples in the LispWorks library. Each example contains complete, self-contained code and detailed comments, which include one or more entry points near the start of the file which you can run to start the program.

To run the example code:

1. Open the file in the Editor tool in the LispWorks IDE. Evaluating the call to `example-edit-file` shown below will achieve this.

2. Compile the example code, by `Ctrl+Shift+B`.

3. Place the cursor at the end of the entry point form and press `Ctrl+X Ctrl+R` to run it.

4. Read the comment at the top of the file, which may contain further instructions on how to interact with the example.

### 20.1 Output pane examples

This section lists the example files illustrating input, drawing, scrolling, tooltips, dragging and images in an output-pane. These are also applicable to static-layout and pinboard-layout.

Processing input with the input-model:
20 Self-contained examples

(def example-edit-file "capi/output-panes/input-model")
(def example-edit-file "capi/output-panes/spirograph")
(def example-edit-file "capi/output-panes/input-model-touch")

Defining a command (that is, an alias to an input gesture):
(def example-edit-file "capi/output-panes/commands")

Drawing to an output pane:

See the following section “Graphics examples” on page 277.

Temporary drawing on top of the normal drawing, for example when the user drags:
(def example-edit-file "capi/output-panes/cached-display")
(def example-edit-file "capi/graphics/pinboard-test")
(def example-edit-file "capi/graphics/pixmap-port")

Simple scrolling without a scroll bar:
(def example-edit-file "capi/output-panes/scrolling-without-bar")

Complex scrolling example:
(def example-edit-file "capi/output-panes/scroll-test")

Using scroll-callback:
(def example-edit-file "capi/graphics/scrolling-test")

Displaying tooltips:
(def example-edit-file "capi/graphics/pinboard-help")

Dragging from/to an output pane:
(def example-edit-file "capi/output-panes/drag-and-drop")

Copying and pasting images in an output pane:
(def example-edit-file "capi/output-panes/drawing")
Indicate selection of objects in response to mouse movement:

\(\text{(example-edit-file "capi/graphics/highlight-rectangle")}\)

Internal scrolling:

\(\text{(example-edit-file "capi/output-panes/pane-can-scroll")}\)

## 20.2 Graphics examples

This section lists the example files illustrating graphics transforms, transparency in images and pixmaps ports, combining existing and new pixels when drawing, drawings dependent on dynamic computations, editing an image, scaling an image, metafiles and paths.

Drawing an image read from a file:

\(\text{(example-edit-file "capi/graphics/images")}\)

Transforms and \textit{apply-rotation-around-point}:

\(\text{(example-edit-file "capi/graphics/rotation-around-point")}\)

\(\text{(example-edit-file "capi/output-panes/cached-display")}\)

Creating transparent and semi-transparent areas in a pixmap:

\(\text{(example-edit-file "capi/graphics/compositing-mode-simple")}\)

Simple example of \textit{compositing-mode}:

\(\text{(example-edit-file "capi/graphics/compositing-mode-simple")}\)

Complex example of \textit{compositing-mode}:

\(\text{(example-edit-file "capi/graphics/compositing-mode")}\)

Simple example of scaling an image:

\(\text{(example-edit-file "capi/graphics/image-scaling")}\)

Draw updates as a slow computation progresses:

\(\text{(example-edit-file "capi/graphics/plot-directly")}\)

Draw something that is computed dynamically and slowly without hanging the GUI:
Using an Image Access object:

(example-edit-file "capi/graphics/image-access")

Pixel-by-pixel editing of an image:

(example-edit-file "capi/graphics/image-access-alpha")

Obtaining BGRA color data from an image:

(example-edit-file "capi/graphics/image-access-bgra")

Handling the alpha channel (transparency) of images:

(example-edit-file "capi/graphics/images-with-alpha")

Creating and using a metafile:

(example-edit-file "capi/graphics/metafile-rotation")

Clipboard access with a metafile:

(example-edit-file "capi/graphics/metafile")

Drawing paths using draw-path:

(example-edit-file "capi/graphics/paths")

Drawing a chart of prices:

(example-edit-file "capi/applications/price-charting")

Effects of drawing-mode:

(example-edit-file "capi/graphics/catherine-wheel")

20.3 Pinboard examples

Simple manipulation of pinboard-objects:

(example-edit-file "capi/graphics/pinboard-movement")

(example-edit-file "capi/graphics/pinboard-test")

(example-edit-file "capi/layouts/wrapping-layout")

Simple manipulation with animation:
20.4 Examples using timers to implement "animation"

(example-edit-file "capi/applications/balloons")

Laying out objects inside pinboard-layout using child layouts:

(example-edit-file "capi/graphics/pinboard-object-text-pane")

Specialized drawing using drawn-pinboard-object:

(example-edit-file "capi/graphics/ruler")
(example-edit-file "capi/graphics/pinboard-test")
(example-edit-file "capi/applications/othello")

Specialized drawing using your own pinboard objects:

(example-edit-file "capi/applications/balloons")

Automatic resizing of pinboard objects:

(example-edit-file "capi/layouts/automatic-resize")

Indicate selection of pinboard objects in response to mouse movement:

(example-edit-file "capi/graphics/highlight-rectangle-pinboard")

20.4 Examples using timers to implement "animation"

(example-edit-file "capi/graphics/rotation-around-point")
(example-edit-file "capi/graphics/metafile-rotation")
(example-edit-file "capi/applications/balloons")
(example-edit-file "capi/applications/pong")

20.5 Drag and Drop examples

From and to output panes:

(example-edit-file "capi/output-panes/drag-and-drop")

From and to list panels:

(example-edit-file "capi/choice/drag-and-drop")

Images from and to list panels:

(example-edit-file "capi/choice/list-panel-drag-images")
GTK+ specific:

(example-edit-file "capi/elements/gtk-filename-list-and-uris")

Minimal drag-and-drop code:

(example-edit-file "capi/elements/simple-dragndrop")

20.6 Graph examples

Simple examples:

(example-edit-file "capi/graphics/graph-pane")
(example-edit-file "capi/choice/simple-graph-pane")

Customizing graph-pane:

(example-edit-file "capi/graphics/circled-graph-nodes")
(example-edit-file "capi/graphics/labelled-graph-edges")
(example-edit-file "capi/graphics/wiggly-line-graph")
(example-edit-file "capi/choice/simple-graph-pane")

20.7 Cocoa-specific examples

Control over the Mac OS X application menu:

(example-edit-file "capi/applications/cocoa-application-single-window")
(example-edit-file "capi/applications/cocoa-application")

20.8 Examples of complete CAPI applications

Simple applications:

(example-edit-file "capi/applications/hangman")
(example-edit-file "capi/applications/maze")
(example-edit-file "capi/applications/maze-multi")
(example-edit-file "capi/applications/othello")
(example-edit-file "capi/applications/pong")
Complete interface, including toolbar, option pane, and multi-column list panel:

Incorporating CPU-intensive work with responsive GUI:

20.9 Choice examples

Different kinds of interaction:

Using print-function and data-function:

Using \texttt{(setf capi:collection-items)} and print-function in a list panel:

Adding images:

Drag and drop in a list panel:

Simple tree-view with images:

Tree-view images and checkboxes:

\texttt{tree-view} combined with an XML parser to display an RSS file:
20.10 Examples of dialogs and prompts

Simple dialog:

(example-edit-file "capi/dialogs/simple-dialog")
(example-edit-file "capi/dialogs/mutating-dialog")

Customizing prompt-with-list:

(example-edit-file "capi/choice/prompt-with-buttons")

20.11 editor-pane examples

Simple editor pane:

(example-edit-file "capi/editor/editor-pane")
change-callback, text property and editor face:
Callbacks before and after input:

(example-edit-file "capi/editor/change-callback")

20.12 Menu examples

Adding images to menus:

(example-edit-file "capi/elements/menu-with-images")

Defining accelerator keys:

(example-edit-file "capi/elements/accelerators")

Dynamically defining the items in the context menu:

(example-edit-file "capi/elements/pane-popup-menu-items")

Button with a drop-down menu:

(example-edit-file "capi/elements/popup-menu-button")

Menus with a popup-callback:

(example-edit-file "capi/elements/popup-menu-button")

20.13 Miscellaneous examples

A prototype grid implementation, and an example using it:

(example-edit-file "capi/elements/grid")

(example-edit-file "capi/elements/grid-impl")

Converting coordinates between a pane and its ancestors or the screen:

(example-edit-file "capi/elements/convert-relative-position")

Changing the mouse cursor:

(example-edit-file "capi/elements/cursor")

Passing initargs to a pane inside an interface using :make-instance-extra-apply-args:

(example-edit-file "capi/applications/argument-passing")
Server and client for a simple line-based textual chat program:

(example-edit-file "capi/applications/chat")
(example-edit-file "capi/applications/chat-client")

Server and client for a simple textual remote debugger:

(example-edit-file "capi/applications/remote-debugger")
(example-edit-file "capi/applications/remote-debugger-client")

### 20.14 GTK+ specific examples

Defining and using GTK+ resources:

(example-edit-file "capi/elements/gtk-resources")

Dragging URIs:

(example-edit-file "capi/elements/gtk-filename-list-and-uris")

### 20.15 Motif specific examples

Defining and using Motif resources:

(example-edit-file "capi/elements/widget-name")

### 20.16 Layout examples

Simple grid-layout:

(example-edit-file "capi/layouts/titles-in-grid")

Extending cells in grid-layout:

(example-edit-file "capi/layouts/extend")

Dynamic resizing of layouts:

(example-edit-file "capi/layouts/resize-layout")

Define a layout which aligns its children top/bottom and also displays oversized children nicely:

(example-edit-file "capi/layouts/buffer-layout")
A **graph-pane** with a custom layout:

```
(example-edit-file "capi/graphics/simple-layout-definition")
```

## 20.17 Tooltip examples

General tooltips:

```
(example-edit-file "capi/elements/help")
```

Displaying tooltips in an **output-pane**:

```
(example-edit-file "capi/graphics/pinboard-help")
```

## 20.18 Examples illustrating other pane classes

Simple standalone scroll bar:

```
(example-edit-file "capi/elements/scroll-bar")
```

Non-linear integer values in a **slider**:

```
(example-edit-file "capi/elements/slider-print-function")
```

Simple use of progress bars:

```
(example-edit-file "capi/elements/progress-bar")
```

Updating a progress bar from another thread:

```
(example-edit-file "capi/elements/progress-bar-from-background-thread")
```

**text-input-choice** basic functionality:

```
(example-edit-file "capi/elements/text-input-choice")
```

**text-input-pane** basic functionality

```
(example-edit-file "capi/elements/text-input-pane")
```

**text-input-range** basic functionality:

```
(example-edit-file "capi/elements/text-input-range")
```

Toolbar examples:

```
(example-edit-file "capi/elements/toolbar")
```
Docking layout:

(example-edit-file "capi/layouts/docking-layout")

Switchable layout:

(example-edit-file "capi/layouts/switchable")

Rich Text pane:

(example-edit-file "capi/applications/rich-text-editor")

Various buttons:

(example-edit-file "capi/buttons/buttons")

Simple layout in button panel:

(example-edit-file "capi/buttons/button-panel-layout")

tracking-pinboard-layout example:

(example-edit-file "capi/graphics/tracking-pinboard-layout")

simple-network-pane example with labeling of graph edges:

(example-edit-file "capi/graphics/network")

20.19 Printing examples

Simple printing:

(example-edit-file "capi/printing/simple-print-port")

Fitting drawing to a page:

(example-edit-file "capi/printing/fit-to-page")

Printing a drawing on multiple pages:

(example-edit-file "capi/printing/multi-page")

(example-edit-file "capi/printing/page-on-demand")

20.20 Graphic Tools examples

Using the higher level Graphic Tools to draw bar charts and graphs:
(example-edit-file "graphic-tools/bar-chart-example")
(example-edit-file "graphic-tools/graph-example")
Self-contained examples
The following chapter documents symbols exported from the `capi` package.

**abort-callback**  
*Function*

**Summary**  
Aborts out of the context of the current callback.

**Package**  
capi

**Signature**  
```
abort-callback &optional always-abort
```

**Arguments**  
`always-abort`  
A generalized boolean.

**Description**  
The function `abort-callback` aborts out of the context of the current callback, returning `nil` when it is relevant (for example in an `interface confirm-destroy-callback`).

If called outside the context of a callback, if `always-abort` is `t` then `abort-callback` calls `(abort)`, otherwise it just returns.

The default value of `always-abort` is `t`. 
See also  callbacks
           interface
           “Callbacks” on page 19

abort-dialog  Function

Summary  Aborts the current dialog.

Package  capi

Signature  abort-dialog &rest ignored-args

Description  The function abort-dialog aborts the current dialog. For example, it can be made a selection callback from a Cancel button so that pressing the button aborts the dialog. In a similar manner the complementary function exit-dialog can be used as a callback for an OK button.

If there is no current dialog then abort-dialog does nothing and returns nil. If there is a current dialog then abort-dialog either returns non-nil or does a non-local exit. Therefore code that depends on abort-dialog returning must be written carefully. Constructs like this can be useful:

{(unless (capi:abort-dialog)
  (foo))}

Above, foo will be called only if there is no current dialog.

It is not useful to do either:

{(when (capi:abort-dialog)
  (foo))}

or

{(progn
  (capi:abort-dialog)
  (foo))}
as in both cases it is not well-defined whether foo will be called if there is a current dialog.

Example

(capi:display-dialog
  (capi:make-container
   (make-instance 'capi:push-button
     :text "Cancel"
     :callback 'capi:abort-dialog)
   :title "Test Dialog")
)

Also see these examples:

(example-edit-file "capi/dialogs/*")

See also:

exit-dialog
display-dialog
popup-confirm
interface
Chapter 11, “Dialogs: Prompting for Input”

**abort-exit-confirm**

*Function*

**Summary**
Aborts the exiting of a dialog.

**Package**
capi

**Signature**
abort-exit-confirm

**Description**
The function `abort-exit-confirm` can be used to abort the exiting of a confirm. It can be used in the *ok-function* of a confirm, to abort the exit and return to the dialog.

If `abort-exit-confirm` is called outside the exiting of a confirm, it does nothing.

**Example**
This example asks the user for a string. If the string is longer than 20 characters, it confirms with the user that they really want such a long string, and if they do not it returns to the dialog.
(capi:popup-confirm
 (make-instance 'capi:text-input-pane)
 "New Name"
 :value-function 'capi:text-input-pane-text
 :ok-function
 #'(lambda (value)
    (when (and (> (length value) 20)
               (not (capi:prompt-for-confirmation
                    "Name is very long. Use it?")))
            (capi:abort-exit-confirm)
    value))
See also popup-confirm

accepts-focus-p

Generic Function

Summary Determines if an element accepts the focus.

Package capi

Signature accepts-focus-p element => result

Arguments element A CAPI element.

Values result A boolean.

Description Determines if the element element accepts the focus for user input, and controls tabstops.

The method on element uses the value of the accepts-focus-p slot, but methods on some subclasses override this.

accepts-focus-p also influences whether a pane is a tabstop. On Microsoft Windows a pane acts as a tabstop if and only if the function accepts-focus-p returns true and the element accepts-focus-p initarg value is :force. On Motif and Cocoa, a pane acts as a tabstop if and only if the function accepts-focus-p returns true.
activate-pane

**Function**

**Summary**
Gives a pane the input focus and raises the window containing it.

**Package**
capi

**Signature**
activate-pane pane

**Description**
The function activate-pane gives the focus to the pane pane and brings the window containing pane to the front.

If pane cannot accept the focus then activate-pane chooses a sensible alternative inside the same interface.

**Example**
This example demonstrates how to swap the focus from one window to another.

```lisp
(setq text-input-pane
  (capi:contain (make-instance 'capi:text-input-pane)))

(setq button
  (capi:contain (make-instance 'capi:push-button :text "Press Me")))

(capi:activate-pane text-input-pane)
(capi:activate-pane button)
```

**See also**
hide-interface
raise-interface
set-object-automatic-resize
show-interface
Functions

Summary
Perform, or check applicability of, an "edit/select operation" on the active pane.

Signature
active-pane-copy &optional pane
active-pane-copy-p &optional pane
active-pane-cut &optional pane
active-pane-cut-p &optional pane
active-pane-deselect-all &optional pane
active-pane-deselect-all-p &optional pane
active-pane-paste &optional pane
active-pane-paste-p &optional pane
active-pane-select-all &optional pane
active-pane-select-all-p &optional pane
active-pane-undo &optional pane
active-pane-undo-p &optional pane
active-pane-undo &optional pane
active-pane-undo-p &optional pane

Description
These functions perform an "edit/select operation" on the active pane, or check if this operation is currently applicable.

The active pane will be the one on the same screen as pane if pane is non-nil, or otherwise the same screen as the default interface.

These functions find the active pane, that is the pane where keyboard input currently goes. Note that this is not necessarily a pane that is recognized by CAPI. The predicates (those with names ending -p) return true if the operation is currently applicable. The other functions tell the active pane to do the operation.

The edit/select operations are implemented by the pane-interface-* generic functions such as pane-interface-copy-object.

It is not an error to do the operation even if the predicate returns false. It will just do nothing useful.

Examples
(exexample-edit-file "capi/applications/rich-text-editor")

See also
pane-interface-copy-object
"Edit actions on the active element" on page 104

append-items

Generic Function

Summary
Adds to the items in a collection.

Signature
append-items collection new-items

Arguments
collection A collection.
new-items A sequence.
Description

The generic function `append-items` adds the items in `new-items` to the `collection collection`.

This is logically equivalent to recalculating the collection items and calling `(setf collection-items)`. However, `append-items` is more efficient and causes less flickering on screen.

`append-items` can only be used when the `collection` has the default `items-get-function svref`.

Notes

`append-items` cannot be used a `graph-pane` or a `tree-view`.

See also

`collection`
`remove-items`
`replace-items`
Chapter 5, “Choices - panes with items”

apply-in-pane-process

Function

Summary

Applies a function in the process associated with a pane.

Package
capi

Signature

`apply-in-pane-process pane function &rest args => nil`

Description

The function `apply-in-pane-process` applies `function` to `args` in the process that is associated with `pane`. This is required when `function` modifies `pane` or changes how it is displayed. If `pane` has not been displayed yet, then `function` is called immediately.
Notes

1. All accesses (reads as well as writes) on a pane should be performed in the pane’s process. Within a callback on the pane’s interface this happens automatically, but apply-in-pane-process is a useful utility in other circumstances.

2. apply-in-pane-process calls function on the current process if the pane’s interface does not have a process.

3. If the pane’s process is no longer active then apply-in-pane-process applies function directly.

4. apply-in-pane-process-if-alive is another way to call function in the CAPI process appropriate for pane. However it only does this if pane is alive so in particular, if pane does not have a process, it does not call function.

Example

Editor commands must be called in the correct process:

```lisp
(setq editor
  (capi:contain
   (make-instance 'capi:editor-pane
                :text "Once upon a time...")))

(capi:apply-in-pane-process editor 'capi:call-editor editor "End Of Buffer")

(capi:apply-in-pane-process editor 'capi:call-editor editor "Beginning Of Buffer")
```

See also

apply-in-pane-process-if-alive
execute-with-interface
“The correct thread for CAPI operations” on page 39
Chapter 7, “Programming with CAPI Windows”

apply-in-pane-process-if-alive

Function

Summary
Applies a function in the process associated with a pane.

Package
capi
**Signature**

apply-in-pane-process-if-alive pane function &rest args => alivep

**Values**

alivep  
A boolean.

**Description**

The function apply-in-pane-process-if-alive applies function to args in the process that is associated with pane, if pane is "alive". This is like apply-in-pane-process except that function is called only if the pane is alive. The meaning of "alive" and the value of alivep are as defined for interface in execute-with-interface-if-alive.

If pane does not have a process, then function is not called.

**See also**

apply-in-pane-process  
execute-with-interface-if-alive  
"The correct thread for CAPI operations" on page 39  
Chapter 7, "Programming with CAPI Windows"

---

**arrow-pinboard-object**

**Class**

**Summary**

A pinboard-object that draws itself as an arrow.

**Package**

capi

**Superclasses**

line-pinboard-object

**Subclasses**

double-headed-arrow-pinboard-object  
labelled-arrow-pinboard-object

**Initargs**

:head  
A keyword specifying the position of the arrowhead on the line.

:head-direction  
A keyword specifying the direction of the arrowhead.

:head-length  
The length of the arrowhead.
:head-breadth The breadth of the arrowhead, or nil.

:head-graphics-args
A graphics args plist.

Description
An instance of the class arrow-pinboard-object is a pinboard-object that draws itself as an arrow.

head must be :end, :middle or :start. The default is :end.

head-direction must be :forwards, :backwards or :both. The default is :forwards.

head-length is the length of the arrowhead in pixels. It defaults to 12.

head-breadth is the breadth of the arrowhead in pixels, or nil which means that the breadth is half of head-length. The default is nil.

head-graphics-args is a plist of graphics state parameters and values used when drawing the arrow head. For information about the graphics state, see graphics-state.
Example

{capi:contain
 (make-instance 'capi:pinboard-layout
 :description (list
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 10
 :end-x 105 :end-y 60 )
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 110
 :end-x 105 :end-y 160
 :head :middle)
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 210
 :end-x 105 :end-y 260
 :head-direction :both )
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 310
 :end-x 105 :end-y 360
 :head-graphics-args '(:foreground :pink)
 :head-length 30)
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 410
 :end-x 105 :end-y 460
 :head-length 30 :head-breadth 5)
 (make-instance 'capi:arrow-pinboard-object
 :start-x 5 :start-y 510
 :end-x 105 :end-y 560
 :head-breadth 10
 :head-direction :backwards))
 :visible-min-width 120
 :visible-min-height 620))

See also

graphics-state
“Creating graphical objects” on page 187

attach-interface-for-callback

Function

Summary
Changes the interface that is passed when a callback is made.

Package
capi
attach-interface-for-callback

Description

The function attach-interface-for-callback changes the interface that is passed when a callback is made. Call-backs for element get passed interface instead of element’s parent interface.

See also

callbacks
element
element-interface-for-callback
interface
“Callbacks” on page 19

attach-simple-sink

Summary

Attaches a sink to the active component in an ole-control-pane.

Package
capi

Signature

attach-simple-sink invoke-callback pane interface-name &key sink-class => sink

Arguments

invoke-callback A function designator.
pane An ole-control-pane.
interface-name A refguid or the symbol :default.
sink-class A symbol naming a class.

Values

sink The sink object.

Description

The function attach-simple-sink make a sink object and attaches it to the active component in pane.

When an event callback is triggered for the source interface named by interface-name, the sink object will call the invoke-callback with four arguments: the pane (see sink-class below),
the source method name as a string, the source method type (either :method, :get or :put) and a vector of the remaining callback arguments.

interface-name is either a string naming a source interface that the component in pane supports or :default to connect to the default source interface.

sink-class can be used to control the class of the sink object. This defaults to ole-control-pane-simple-sink, but can be a subclass of this class to allow the first argument of the invoke-callback to be chosen by a method on the generic function com:simple-i-dispatch-callback-object.

Attached sinks are automatically disconnected when the object is closed or can be manually disconnected by calling detach-simple-sink.

Notes
This function is implemented only in LispWorks for Windows. Load the functionality by (require "embed").

See also
detach-simple-sink
ole-control-pane
ole-control-pane-simple-sink

attach-sink

Summary
Attaches a sink to the active component in an ole-control-pane.

Package
capi

Signature
attach-sink sink pane interface-name

Arguments
sink A class instance.
pane An ole-control-pane.
interface-name A refguid or the symbol :default.
The function **attach-sink** attaches a sink to the active component in the the **ole-control-pane** 

*sink* is an instance of a class that implements the source interface **interface-name**.

*pane* is an **ole-control-pane** which is the pane where the component is.

**interface-name** is either a string naming a source interface that the component in *pane* supports or **:default** to connect to the default source interface.

Attached sinks are automatically disconnected when the object is closed or can be manually disconnected by calling **detach-sink**.

**Notes**

This function is implemented only in LispWorks for Windows. Load the functionality by (**require "embed"**).

**See also**

**attach-simple-sink**  
**detach-sink**  
**ole-control-pane**

---

### beep-pane

**Function**

**Summary**  
Sounds a beep.

**Package**  
capi

**Signature**  
beep-pane &optional pane

**Description**  
The function **beep-pane** sounds a beep on the screen associated with *pane* or on the current screen if *pane* is **nil**.

**Example**  
(capi:beep-pane)
browser-pane

Summary
Embeds a pane that can display HTML. Implemented only on Microsoft Windows and Cocoa.

Superclasses
simple-pane

Subclasses
None

Initargs
: before-navigate-callback
A function that is called before navigating, or nil.

: navigate-complete-callback
A function that is called when navigation completes, or nil.

: new-window-callback
A function that is called before opening a new window, or nil.

: status-text-change-callback
A function that is called when there is a new status text or nil.

: document-complete-callback
A function that is called when a document is complete, or nil.

: title-change-callback
A function that is called when the title changes, or nil.
A function that is called when the enabled status of commands related to the pane may need to change, or nil.

**internet-explorer-callback**

Microsoft Windows specific: A function that is whenever there is an event from the underlying IWebBrowser2, or nil.

**navigate-error-callback**

A function that is called when the pane fails to navigate, or nil.

**debug**

A boolean specifying whether debugging mode is on or not.

**url**

A string specifying the initial URL.

**Accessors**

- browser-pane-navigate-complete-callback
- browser-pane-new-window-callback
- browser-pane-status-text-change-callback
- browser-pane-document-complete-callback
- browser-pane-title-change-callback
- browser-pane-update-commands-callback
- browser-pane-internet-explorer-callback
- browser-pane-before-navigate-callback
- browser-pane-navigate-error-callback
- browser-pane-debug

**Readers**

- browser-pane-url
- browser-pane-successful-p
- browser-pane-title

**Description**

A **browser-pane** is a pane that embeds a pane that can display HTML. Navigation in the pane happens either by the user clicking on hyperlinks, or by the application using **browser-pane-navigate**. The various callbacks gives the program information on what happens in the window and can be used to control (for example, to block or redirect pages).
browser-pane is implemented only on Microsoft Windows (where it embeds an IWebBrowser2) and Cocoa (where it uses WebKit).

The initarg :url specifies the initial URL. After being created, the pane automatically navigates to this URL.

When before-navigate-callback is non-nil, it is called before any navigation (whether programmatic or by the user), and gives the application control over whether to perform the navigation. The callback must have this signature:

```lisp
before-navigate-callback pane url &key hyper-link-p sub-frame-p frame-name post-data headers &allow-other-keys => do-it-p
```

```lisp
before-navigate-callback pane url &key sub-frame-p frame-name &allow-other-keys => do-it
```

`pane` is the pane that navigates, and `url` is a string to which it wants to navigate. `sub-frame-p` is true when the navigation is for a sub-frame inside the current URL, otherwise `sub-frame-p` is `nil`. `frame-name` is either `nil` or the name of a sub-frame when the navigation is to a sub-frame.

If `before-navigate-callback` returns `nil`, the navigation is cancelled.

**Note:** To perform a redirection, just call `browser-pane-navigate` to the required URL, and return `nil` from `before-navigate-callback`.

If new-window-callback is non-nil, it is called before the pane tries to open a new window. It must have this signature:

```lisp
new-window-callback pane url &key context flags &allow-other-keys => do-it-p
```

`pane` is the pane that wants to open a new window, and `url` is a string containing the URL that the new window will navigate to. `context` is a string containing the URL of the page from which the request comes.
flags is implementation-specific flags. On Cocoa flags is always 0. On Microsoft Windows flags contains bits from the NWMF enumeration.

If new-window-callback returns nil, the opening of the new window is cancelled. If new-window-callback returns t or is not supplied, it launches a browser using the OS settings.

On Microsoft Windows, new-window-callback is invoked from the "NewWindow3" event (or "NewWindow2" for old versions) of the sink of the underlying IWebBrowser2. If not cancelled, the pane opens a new normal Internet Explorer window.

If document-complete-callback is non-nil, it is called when the new document in the pane is complete. It must be a function with signature:

\[
\text{document-complete-callback} \Rightarrow \text{pane url title}
\]

url is the loaded URL, and may be nil in the case of failure. title is a string that is associated with the URL url (or the previous URL if the latest call failed).

document-complete-callback is called when, as far as the system is concerned, all the data for the URL has been loaded and is displayed in the pane. There is only one call to document-complete-callback for each navigation of the pane.

If navigate-complete-callback is non-nil, it is called whenever a navigation completes. navigate-complete-callback can be called several times for each navigation of the pane. It must be a function with the signature:

\[
\text{navigate-complete-callback} \text{ pane url sub-frame-p} \Rightarrow
\]

pane is the pane that is navigated. url is a string to which it navigated, unless the navigation failed, in which case url is nil. sub-frame-p is true when the navigation was in a sub-frame.
Notes: For most purposes the document-complete-callback is more useful than navigate-complete-callback. When navigate-complete-callback gets a nil url, the value of the URL in the pane (that is, what the accessor browser-pane-url returns) is still set to the actual URL. The success flag (which you can read with browser-pane-successful-p) is set to nil.

url can be non-nil even if there was an error in the navigation, if the server supplied another URL. In this case, on Microsoft Windows only, the success flag is set to :redirected. You can read it with browser-pane-successful-p.

If navigate-error-callback is non-nil, it is called when navigation fails for some reason. It should have this signature:

navigate-error-callback pane url &key http-code error-symbol implementation-error-code message frame-name sub-frame-p fatal &allow-other-keys => cancel

pane is the navigating pane, and url is the URL that got the error.

If the failure is server-side failure, then http-code contains the http-code in the response of the server, otherwise (that is, when it failed to connect to a server) it is nil.

error-symbol is a keyword uniquely identifying the error. For an http error it is of the form :HTTP_STATUS*, and for requests with bad syntax error-symbol is :bad-request.

On Microsoft Windows implementation-error-code is the code in the "NavigateError" event. If http-code is non-nil then implementation-error-code and http-code will be the same. On Cocoa implementation-error-code will be the same as http-code in the case of server-side failure, otherwise it is one of the NSURLConnection constants.

fatal is a boolean. A true value means that nothing is going to be displayed in the pane to tell the user about the error.

message is a message saying what the error is. sub-frame-p is t when the navigation is for a sub-frame, otherwise nil. frame-name is the name of the frame.
The return value *cancel* of `navigate-error-callback` should be one of `nil`, `t`, or `:stop`, with these interpretations:

- **nil**
  - On Microsoft Windows this means displaying either the substitution page from the server if there is one, or displaying automatically generated (by the underlying IWebBrowser2) error page.

- **t**
  - Cancel. On Microsoft Windows this means not displaying the automatically generated error page, but displaying server substitution if there is any.

- **:stop**
  - Stop the navigation immediately.

Note that the effect of the returned value *cancel* is only on the specific navigation, so it possible for a sub-frame to be stopped, while the main page and maybe other sub-frames complete.

On Cocoa there is no automatically generated error page, so the return value of *cancel* `nil` means the same as `t`, and both display whatever the server returned.

**Note:** To redirect on error, `navigate-error-callback` should just call `browser-pane-navigate` with the new page and return `:stop`.

If `title-change-callback` is non-nil, it is called when the title of the pane should change. It should have this signature:

```lisp
title-change-callback pane new-title
```

`new-title` is a string, which the application should use as the title of the pane.

**Note:** In most cases, using the `title` argument of the `document-complete-callback` is more useful.

If `status-text-change-callback` is non-nil, it is called when the status text of the pane should change. It has this signature:

```lisp
status-text-change-callback pane new-status-text
```
new-status-text is a string, which the application should use as the status text for the pane.

If update-commands-callback is non-nil, it is called when other panes (typically buttons or menu items) that are used to perform commands on the pane need to update. The callback has this signature:

\[
\text{update-commands-callback pane what enabled-p}
\]

Currently what can be one of:

- **:forward** Other panes that are used to go forward in the pane should be enabled or disabled.
- **:backward** Other panes that are used to go backward in the pane should be enabled or disabled.

Additionally on Microsoft Windows only, what can be:

- **t** Other panes that may try to anything with the pane may need updating. Note that this callback is called quite often with what = t, so make sure it usually does not do much work in this case.

enabled-p specifies whether the other panes should be enabled or disabled.

On Windows only, if internet-explorer-callback is non-nil, it is called for each event for the pane. It has the signature

\[
\text{internet-explorer-callback pane event-name args}
\]

\text{event-name} is a string specifying the event. \text{args} is a vector containing the arguments in order. The callback is called before any code that is used to implement the callbacks, which is called afterwards with the same argument vector. That means that the callback should not set anything in the vector, except when debugging.
internet-explorer-callback is intended to add functionality that is not given by the callbacks, and for debugging (but see also :debug). If you need more control, you probably want to define your pane directly: for the basics see:

(example-edit-file "com/ole/html-viewer")

debug specifies that the pane should be in debugging mode. Currently, on Microsoft Windows this means that it prints each event and the arguments that it receives. Whenever an event is sent to the sink associated with the embedded browser, the method name (which is the same as the event name in this case) and the argument are printed to mp:*background-standard-output*. On Cocoa it prints some diagnostics to mp:*background-standard-output*.

browse-pane-url returns the current url of the pane. Initially the value is the keyword :url, but once the browser completed navigation to some URL it is changed to this. Note that the url changes even if the navigation was not successful, as long as it was not stopped or cancelled and there was no substitution page.

browse-pane-title returns the title of the current document. Note that during navigation browse-pane-title and browse-pane-url may not be synchronised. They are synchronised when document-complete-callback is called, until the next before-navigate-callback call.

browser-pane-successful-p tests whether the navigation to the current URL completed successfully, returning nil for failure and t for success. On Microsoft Windows only it can also return :substituted, which means that the server returned an error but also supplied a substitution page. On Cocoa, browser-pane-successful-p returns only t or nil.

Notes

browser-pane and related APIs are implemented on Microsoft Windows and Cocoa only. You can test whether it is available by browser-pane-available-p.
See also  
browser-pane-available-p  
browser-pane-navigate  
browser-pane-busy  
browser-pane-refresh  
“Displaying rich text” on page 27

### browser-pane-available-p

**Function**

**Summary**  
The predicate for whether browser-pane can be used on a specified screen.

**Package**  
capi

**Signature**  
`browser-pane-available-p &optional screen-spec => result`

**Arguments**  
`screen-spec`  
A CAPI object, a plist, or nil.

**Values**  
`result`  
A boolean.

**Description**  
The function `browser-pane-available-p` returns true if there is a browser-pane implementation for the library associated with `screen-spec`.  
If `screen-spec` is not supplied, the default library is used.  
If `screen-spec` is supplied, it must be a valid argument to `convert-to-screen`.

**See also**  
browser-pane  
convert-to-screen
browser-pane-busy
browser-pane-go-forward
browser-pane-go-back
browser-pane-navigate
browser-pane-refresh
browser-pane-stop

Functions

Summary Controls a browser-pane.

Signature

<table>
<thead>
<tr>
<th>Function</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>browser-pane-navigate</td>
<td>pane url =&gt; result</td>
</tr>
<tr>
<td>browser-pane-busy</td>
<td>pane =&gt; result</td>
</tr>
<tr>
<td>browser-pane-go-back</td>
<td>pane</td>
</tr>
<tr>
<td>browser-pane-go-forward</td>
<td>pane</td>
</tr>
<tr>
<td>browser-pane-stop</td>
<td>pane</td>
</tr>
<tr>
<td>browser-pane-refresh</td>
<td>pane &amp;optional level</td>
</tr>
</tbody>
</table>

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pane</td>
<td>A browser-pane.</td>
</tr>
<tr>
<td>url</td>
<td>A string.</td>
</tr>
<tr>
<td>level</td>
<td>One of the keywords :normal and :refresh_completely.</td>
</tr>
</tbody>
</table>

Values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>result</td>
<td>A boolean.</td>
</tr>
<tr>
<td>name</td>
<td>A string.</td>
</tr>
</tbody>
</table>

Description

These functions are used to control an instance of browser-pane.

**browser-pane-navigate** navigates to the supplied URL, that is it gets and displays the contents of the URL. Note that if there is any redirection, it is the redirected URL that is displayed.
**browser-pane-navigate** does the navigation asynchronously, so when the function returns the navigation has just started. If `result` is true then the navigation started, and if `result` is `nil` then some error in the URL has already been detected. If the pane has an error callback, it already has been called in this case.

**Note:** `browser-pane-navigate` can be used to effect a redirection from inside the error before navigation and new-window callbacks.

**browser-pane-busy** tests whether the browser is currently navigating, returning true if it is.

**browser-pane-go-forward** and **browser-pane-go-back** navigate forward and back in the history, like the buttons on most web browsers.

**browser-pane-stop** stops the current navigation.

**browser-pane-refresh** refreshes the pane, which means re-reading the URL. `level` can be one of:

- **:normal** Asks the server for the contents again. This is the default value of `level`.
- **:refresh_completely** Asks the server for the contents again without looking at any cache (it uses header `Pragma:no-cache`).

**Notes**

`browser-pane` and related APIs are implemented on Microsoft Windows and Cocoa only.

**Compatibility note**

In LispWorks 6.1 these functions were documented as generic functions, however it is not intended that you should define methods.

**See also**

`browser-pane`
**browser-pane-property-get**

**browser-pane-property-put**

*Generic Functions*

**Summary**

Get or set value of a specified Windows property of the underlying browser.

**Signature**

*browser-pane-property-get* pane property-name

*browser-pane-property-put* pane property-name value

**Description**

property-name has to be one of the properties listed in the Properties section of the documentation of IWebBrowser2 in the MSDN.

**Notes**

1. *browser-pane-property-get* and *browser-pane-property-put* are implemented on Microsoft Windows only.

2. *browser-pane-property-get* and *browser-pane-property-put* do not correspond to the methods "GetProperty" and "PutProperty" of IWebBrowser2.

**See also**

*browser-pane*

---

**button**

*Class*

**Summary**

A button is a pane that displays either a piece of text or an image, and that performs an action when pressed. Certain types of buttons can also be selected and deselected.

**Package**

capi

**Superclasses**

*simple-pane*

*item*

**Subclasses**

*push-button*

*radio-button*

*check-button*
Initargs

:interaction  The interaction style for the button.
:selected    For radio button and check button styles, if selected is set to t, the button is initially selected.
:callback    Specifies the callback to use when the button is selected.
:image       An image for the button (or nil).
:selected-image
               The image used when the button is selected.
:enabled     If nil the button cannot be selected.
:cancel-p    If true the button is the "Cancel" button, that is, the button selected by the Escape key.
:default-p   If true the button is the default button, that is, the button selected by the Return key.

The following two initargs controlling alternate images apply only on Motif and Microsoft Windows:

:disabled-image
       The image for the button when disabled (or nil).
:selected-disabled-image
       The image used when the button is selected and disabled.

The following initarg controlling another alternate image applies only on GTK+ and Motif and Microsoft Windows:

:armed-image
       The image used when the button is pressed and interaction is :no-selection.

The following initargs controlling mnemonics apply only on Microsoft Windows and GTK+:

:mnemonic  A character, integer or symbol specifying a mnemonic for the button.
:mnemonic-text
A string specifying the text and a mnemonic.

:mnemonic-escape
A character specifying the mnemonic escape. The default value is #\&.

**Accessors**
- button-selected
- button-image
- button-armed-image
- button-selected-image
- button-disabled-image
- button-selected-disabled-image
- button-enabled
- button-cancel-p
- button-default-p

**Description**
The class button is the class that push-button, radio-button, and check-button are built on. It can be displayed either with text or an image, and a callback is called when the button is clicked. It inherits all of its textual behavior from item, including the slot text which is the text that appears in the button.

Rather than creating direct instances of button, you usually create instances of its subclasses, each of which has a specific interaction style. Occasionally it may be easier to instantiate button directly with the appropriate value of interaction (for instance, when the interaction style is only known at runtime) but you may not use such a button as an item in a button-panel.

The values allowed for interaction are as follows:

: no-selection A push button.

: single-selection
A radio button.

: multiple-selection
A check button.
Both radio buttons and check buttons can have a selection which can be set using the initarg `:selected` and the accessor `button-selected`.

The button’s callback gets called when the user clicks on the button, and by default gets passed the data in the button and the interface. This can be changed by specifying a callback type as described in the description of callbacks. The following callbacks are accepted by buttons:

- **:selection-callback**
  Called when the button is selected.

- **:callback**
  For buttons this is a synonym of `:selection-callback`.

- **:retract-callback**
  Called when the button is deselected.

By default, `image` and `disabled-image` are `nil`, meaning that the button is a text button, but if `image` is provided then the button displays an image instead of the text. The image can be an `external-image` or any object accepted by `load-image`, including a `.ico` file on Microsoft Windows. The disabled image is the image that is shown when the button is disabled (or `nil`, meaning that it is left for the window system to decide how to display the image as disabled). On some platforms the system computes the disabled image and so `disabled-image` is ignored.

The button's actions can be enabled and disabled with the `enabled` slot, and its associated accessor `button-enabled`. This means that when the button is disabled, pressing on it does not call any callbacks or change its selection.

Note that the class `button-panel` provides functionality to group buttons together, and should normally be used in preference to creating individual buttons yourself. For instance, a
radio-button-panel makes a number of radio buttons and also controls them such that only one button is ever selected at a time.

A mnemonic is an underlined character within the button text or the printed representation of the button data which can be entered to select the button. The value mnemonic is interpreted as described for menu.

An alternative way to specify a mnemonic is to pass mnemonic-text. This is a string which provides the text for the button and also specifies the mnemonic character. mnemonic-text and mnemonic-escape are interpreted in just the same way as the mnemonic-title and mnemonic-escape of menu.

Notes

1. The simple-pane initarg foreground is not supported for buttons on Windows and Cocoa.
2. The disabled-image, armed-image and selected-disabled-image will work on Microsoft Windows provided you are running with the themed look-and-feel (which is the default). See “Using Windows themes” on page 267.

Example

In the following example a button is created. Using the button-enabled accessor the button is then enabled and disabled.

(setq button
      (capi:contain (make-instance 'capi:push-button :text "Press Me")))

(capi:apply-in-pane-process
 button #'(setf capi:button-enabled) nil button)

(capi:apply-in-pane-process
 button #'(setf capi:button-enabled) t button)

In the next example a button with an image instead of text is created.
(setq button
  (capi:contain
    (make-instance
      'capi:push-button
      :image
      (example-file
        "capi/applications/images/info.bmp")))))

The following examples illustrate mnemonics:

(defun egg (&rest ignore)
  (declare (ignore ignore))
  (capi:display-message "Egg"))

(capi:contain
  (make-instance 'capi:push-button
    :selection-callback 'egg
    :mnemonic-text "Chicken & Rice"))

(capi:contain
  (make-instance 'capi:push-button
    :data "Chicken"
    :selection-callback 'egg
    :mnemonic #\k))

Compare this with the previous example: the #\k does not appear and the #\e becomes the mnemonic:

(capi:contain
  (make-instance 'capi:push-button
    :selection-callback 'egg
    :mnemonic-escape #\k
    :mnemonic-text "Chicken"))

Also see these examples:

(example-edit-file "capi/buttons/*")

See also

button-panel
callbacks
"Button elements" on page 31
"Working with images" on page 219
The class **button-panel** is a pane containing a number of buttons that are laid out in a particular style, and that have group behavior.

**Package**
```
capi
```

**Superclasses**
```
choice
titled-object
simple-pane
```

**Subclasses**
```
push-button-panel
radio-button-panel
check-button-panel
```

**Initargs**
```
:layout-class The type of layout for the buttons.
:layout-args Initialization arguments for the layout.
:callbacks The selection callbacks for each button.
:button-class The class of the buttons.
:images A list.
:disabled-images A list.
:armed-images A list.
:selected-images A list.
:selected-disabled-images A list.
:help-keys A list.
:default-button Specifies the default button.
:cancel-button Specifies the cancel button.
The following initargs controlling mnemonics apply only on Microsoft Windows:

:mnenonics A list specifying mnemonics for the buttons.

:mnenonic-items A list of strings, each specifying the text and a mnemonic.

:mnenonic-escape A character specifying the mnemonic escape. The default value is #\&.

:mnenonic-title A string specifying the title and a mnemonic.

Accessors pane-layout

Description The class button-panel inherits most of its behavior from choice, which is an abstract class providing support for handling items and selections. By default, a button panel has single selection interaction style (meaning that only one of the buttons can be selected at any one time), but this can be changed by specifying an interaction.

The subclasses push-button-panel, radio-button-panel and check-button-panel are provided as convenience classes, but they are just button panels with different interactions (:no-selection, :single-selection and :multiple-selection respectively).

The layout of the buttons is controlled by a layout of class layout-class (which defaults to row-layout) but this can be changed to be any other CAPI layout. When the layout is created, the list of initargs layout-args is passed to make-instance.
Each button uses the callbacks specified for the button panel itself, unless the argument *callbacks* is specified. *callbacks* should be a list (one element per button). Each element of *callbacks*, if non-nil, will be used as the selection callback of the corresponding button.

*button-class*, if supplied, determines the class used for each of the buttons. This should be the class appropriate for the *interaction*, or a subclass of it. The default behavior is to create buttons of the class appropriate for the *interaction*.

Each of *images*, *disabled-images*, *armed-images*, *selected-images*, *selected-disabled-images* and *help-keys*, if supplied, should be a list of the same length as *items*. The values are passed to the corresponding item, and interpreted as described for *button*. The *button-panel images* values map to *button image* arguments, and so on.

For *button-panel* and its subclasses, the *items* supplied to the :items initarg and (setf collection-items) function can contain button objects. In this case, the button is used directly in the button panel rather than a button being created by the CAPI.

This allows button size and spacing to be controlled explicitly. Note that the button must be of the appropriate type for the subclass of *button-panel* being used, as shown in the following table:

<table>
<thead>
<tr>
<th>Button panel class</th>
<th>Button class</th>
</tr>
</thead>
<tbody>
<tr>
<td>push-button-panel</td>
<td>push-button</td>
</tr>
<tr>
<td>radio-button-panel</td>
<td>radio-button</td>
</tr>
<tr>
<td>check-button-panel</td>
<td>check-button</td>
</tr>
</tbody>
</table>

Table 21.1  Button and panel classes
For example,

```lisp
(let ((button1 (make-instance 'capi:push-button
  :text "button1"
  :internal-border 20
  :visible-min-width 200))
  (button2 (make-instance 'capi:push-button
  :text "button2"
  :internal-border 20
  :visible-min-width 200)))
  (capi:contain (make-instance 'capi:push-button-panel
    :items (list button1 button2)
    :layout-args '((:x-gap 30)))))
```

default-button specifies which button is the default (selected by pressing Return). It should be equal to a member of items when compared by test-function. If the items are non-immediate objects such as strings or button objects, you must ensure either that the same (eq) object is passed in items as in default-button, or that a suitable test-function is supplied.

cancel-button specifies which button is selected by pressing Escape. The comparison with members of items is as for default-button.

mnemonics is a list of the same length as items. Each element is a character, integer or symbol specifying the mnemonic for the corresponding button in the same way as described for menu.

mnemonic-items is an alternate way to specify the mnemonics in a button panel. It is a list of the same length as items. Each element is a string which is interpreted for the corresponding button as its mnemonic-text initarg.

mnemonic-title and mnemonic-escape are interpreted as for menu. mnemonic-escape specifies the escape character for mnemonics both in the buttons and in the pane’s title.
Compatibility note

Button panels now default to having a maximum size constrained to their minimum size as this is useful when attempting to layout button panels into arbitrary spaces without them changing size. To get the old behavior, specify :visible-max-width nil in the make-instance.

Example

(capi:contain (make-instance
  'capi:button-panel
  :items '(:red :green :blue)
  :print-function 'string-capitalize))

(setq buttons
  (capi:contain
   (make-instance
    'capi:button-panel
    :items '(:red :green :blue)
    :print-function 'string-capitalize
    :interaction :multiple-selection)))

(capi:apply-in-pane-process
  buttons #'(setf capi:choice-selected-items)
  '((:red :green) buttons))

(capi:contain (make-instance
  'capi:button-panel
  :items '(1 2 3 4 5 6 7 8 9)
  :layout-class 'capi:grid-layout
  :layout-args '(:columns 3)))

This example illustrates use of default-button and test-function:

(capi:contain (make-instance
  'capi:push-button-panel
  :items '("one" "two" "three")
  :default-button "two"
  :test-function 'equalp
  :selection-callback
  'capi:display-message))

Also see these example files:

(example-edit-file "capi/buttons/buttons")

(example-edit-file "capi/buttons/button-panel-layout")
See also  
radio-button  
check-button  
push-button  
set-button-panel-enabled-items  
Chapter 5, “Choices - panes with items”

calculate-constraints  

Generic Function  

Summary  
Calculates the internal constraints of a pane.

Package  
capi

Signature  
calculate-constraints pane

Arguments  
pane  
A CAPI pane or layout.

Description  
The generic function calculate-constraints calculates the internal constraints for pane according to the sizes of its children, and sets these values into pane's geometry cache.

When the pane does not scroll in the relevant dimension, all the geometry hints (:external-min-width, :visible-max-height and so on) override the values that are computed by calculate-constraints.

When the pane does scroll in the relevant dimension, :internal-min-width and :internal-min-height override the values that are computed by calculate-constraints. (:internal-max-width and :internal-max-height are ignored when scrolling.)

See “Width and height hints” on page 80 for a description of internal and external constraints.

The CAPI calls calculate-constraints for each pane and layout that it displays.
When creating your own layout, you should define a method for `calculate-constraints` that sets the values of the following geometry slots based on the constraints of its children.

%min-width%  The minimum width of `pane`.
%max-width%  The maximum width of `pane`.
%min-height% The minimum height of `pane`.
%max-height% The maximum height of `pane`.

(See `with-geometry`.)

The constraints of any CAPI element can be found by calling `get-constraints`.

See also `calculate-layout`  
`define-layout`  
`get-constraints`  
`element`  
`layout`  
`with-geometry`  
Chapter 7, “Programming with CAPI Windows”

### `calculate-layout`  

**Generic Function**

**Summary**  Provides a method for laying out the children of a new layout.

**Package**  `capi`

**Signature**  `calculate-layout layout x y width height`

**Description**  The generic function `calculate-layout` is called by the CAPI to layout the children of a layout. When defining a new class of layout using `define-layout`, a `calculate-layout` method must be provided that sets the `x`, `y`, `width` and `height`
of each of the layout’s children. This method must try to obey the constraints specified by its children (its minimum and maximum size) and should only break them when it becomes impossible to fit the constraints of all of the children.

To set the $x$, $y$, width and height of the layout, use the macro \texttt{with-geometry} which works in a similar way as \texttt{with-slots}.

See also \texttt{get-constraints} \texttt{with-geometry} \texttt{interpret-description}

Chapter 6, “Laying Out CAPI Panes”

\textbf{call-editor} \\
\textit{Generic Function}

\textbf{Summary} \\
Executes an editor command in an \texttt{editor-pane}.

\textbf{Package} \\
capi

\textbf{Signature} \\
call-editor \textit{editor-pane} \textit{command}

\textbf{Description} \\
The generic function \texttt{call-editor} executes the editor command \textit{command} in the current buffer in \texttt{editor-pane}.

It can be used directly in a callback in \texttt{editor-pane}'s interface. See “Connecting an interface to an application” on page 147. In other cases, take care to modify displayed CAPI interfaces only in their own process: \texttt{execute-with-interface} and \texttt{apply-in-pane-process} are useful for this.

The \textit{before-input-callback} and \textit{after-input-callback} of the \texttt{editor-pane} are called when \texttt{call-editor} is called.

\textbf{Example} \\
\begin{verbatim}
(setq editor (capi:contain
  (make-instance 'capi:editor-pane
    :text "abc")))
\end{verbatim}
(capi:apply-in-pane-process
 editor 'capi:call-editor editor "End Of Buffer")

Also see this example:

(example-edit-file "capi/editor/editor-pane")

See also

apply-in-pane-process
editor-pane
execute-with-interface
"In-place completion” on page 168

callbacks

Class

Summary

The class **callbacks** is used as a mixin by classes that provide callbacks.

Package

capi

Superclasses

capi-object

Subclasses

collection
item
menu-object

Initargs

:callback-type The type of arguments for the callbacks.

:selection-callback

The callback for selecting an item.

:extend-callback

The callback for extending the selection.

:retract-callback

The callback for deselecting an item.

:action-callback

The callback for an action.
:alternative-action-callback

The callback for an alternative action in choice and its subclasses.

Accessors
callbacks-callback-type
callbacks-selection-callback
callbacks-extend-callback
callbacks-retract-callback
callbacks-action-callback

Description

Each callback function can be one of the following:

- **function**
  Call the function.

- **list**
  Apply the head of the list to the tail.

- **:redisplay-interface**
  Call redisplay-interface on the top-level interface.

- **:redisplay-menu-bar**
  Call redisplay-menu-bar on the top-level interface.

The slot value callback-type determines which arguments get passed to each of the callbacks. It can be any of the following values, and passes the corresponding data to the callback function:

- **:collection-data**
  (collection data)

- **:data**
  (item-data)

- **:data-element**
  (item-data element)

- **:data-interface**
  (item-data interface)

- **:element**
  (element)

- **:element-data**
  (element item-data)

- **:element-item**
  (element item)
`interface-data`

(interface item-data)

`item`

(item)

`item-element` (item element)

`item-interface`

(item interface)

`interface-item`

(interface item)

`interface`

(interface)

`full`

(item-data item interface)

:focus

The pane with the current input focus.

:none

()

nil

()

callback-type can also be a list containing any of :focus, :data, :element, :interface, :collection, :item.

The item-data variable is the item’s data if the item is of type item, otherwise it is the item itself, as for item. The item variable means the item itself. The interface is the element-interface of the element. collection is the element’s collection, if there is one. The element variable means the element containing the callback itself.

In a choice, the alternative-action-callback is invoked by a gesture which is the action-callback gesture modified by the Shift key on Microsoft Windows and GTK+, and modified by the Command key on Cocoa.

alternative-action-callback is applicable only to choice and its subclasses.

Apart from being invoked with a different gesture, the alternative-action-callback has exactly the same semantics as action-callback.
can-use-metafile-p

Function

Summary
Queries whether metafiles can be used.

Package
capi

Signature
can-use-metafile-p &optional screen => result

Arguments
screen An object accepted by the function convert-to-screen.

Values
result A boolean.

Description
The function can-use-metafile-p is the predicate for whether the default library (if no argument is passed) or a specified screen (if an argument is passed) can use metafiles.

If the argument screen is supplied, it is converted to a screen by convert-to-screen.

Examples
(example-edit-file "capi/graphics/metafile")

See also
convert-to-screen
default-library
The class `capi-object` is the superclass of all CAPI classes.

Package `capi`

Superclasses `standard-class`

Subclasses `item`
`callbacks`
`element`
`interface`
`pinboard-object`

Initargs

- `:name` The name of the object.
- `:plist` A property list for storing miscellaneous information.

Accessors `capi-object-name`
`capi-object-plist`

Description

The class `capi-object` provides a name and a property list for general purposes, along with the accessors `capi-object-name` and `capi-object-plist` respectively. A `capi-object`'s name is defaulted by `define-interface` to be the name of the slot into which the object is put.

Example

```lisp
(setq object (make-instance 'capi:capi-object
  :name 'test))

(capi:capi-object-name object)

(setf (capi:capi-object-plist object)
  '(:red 1 :green 2 :blue 3))

(capi:capi-object-property object :green)
```

See also `capi-object-property`

“Object properties and name” on page 265
capi-object-property

Summary
Accesses properties in the property list of a capi-object.

Package
capi

Signature
capi-object-property object property

Signature
(setf capi-object-property) value object property

Description
The function capi-object-property gets and sets properties in the property list of a capi-object.
All CAPI objects contain a property list, similar to the symbol plist. The recommended ways of accessing properties are capi-object-property and (setf capi-object-property). To remove a property, use the function remove-capi-object-property.

Example
In this example a list panel is created, and a test property is set and examined using capi-object-property.

(setq pane (make-instance 'capi:list-panel
  :items '(1 2 3)))

(capi:capi-object-property pane 'test-property)

(setf (capi:capi-object-property pane 'test-property) "Test")

(capi:capi-object-property pane 'test-property)

(capi:remove-capi-object-property pane 'test-property)

(capi:capi-object-property pane 'test-property)

See also
capi-object
remove-capi-object-property
“Object properties and name” on page 265
check-button

Summary
A check button is a button that can be either selected or deselected, and its selection is independent of the selections of any other buttons.

Package
capi

Superclasses
button
titled-object

Description
The class check-button inherits most of its behavior from the class button. Note that it is normally best to use a check-button-panel rather than make the individual buttons yourself, as the button panel provides functionality for handling groups of buttons. However, check-button can be used if you need to have more control over the button's behavior.

Example
The following code creates a check button.

```lisp
(setq button (capi:contain
               (make-instance 'capi:check-button
                               :text "Press Me")))
```

The button can be selected and deselected using this code.

```lisp
(capi:apply-in-pane-process
  button #'(setf capi:button-selected) t button)

(capi:apply-in-pane-process
  button #'(setf capi:button-selected) nil button)
```

The following code disables and enables the button.

```lisp
(capi:apply-in-pane-process
  button #'(setf capi:button-enabled) nil button)

(capi:apply-in-pane-process
  button #'(setf capi:button-enabled) t button)
```
See also push-button
radio-button
button-panel
“Button elements” on page 31

check-button-panel

Class

Summary A check-button-panel is a pane containing a group of buttons each of which can be selected or deselected.

Package capi

Superclasses button-panel

Description The class check-button-panel inherits all of its behavior from button-panel, which itself inherits most of its behavior from choice. Thus, the check-button-panel can accept items, callbacks, and so on.

Example

{(capi:contain (make-instance 'capi:check-button-panel
:title "Select some packages"
:items '("CAPI" "LISPWORKS" "CL-USER")))

(setq buttons (capi:contain
(make-instance
'capi:check-button-panel
:title "Select some packages"
:items '("CAPI" "LISPWORKS" "CL-USER"
:layout-class 'capi:column-layout)))

(capi:choice-selected-items buttons)

Also see this example:

(example-edit-file "capi/buttons/buttons")
See also  
check-button
push-button-panel
radio-button-panel
Chapter 5, “Choices - panes with items”

choice

Class

Summary  
A choice is an abstract class that collects together a group of items, and provides functionality for displaying and selecting them.

Package  
capi

Superclasses  
collection

Subclasses  
button-panel
double-list-panel
extended-selection-tree-view
graph-pane
list-panel
menu-component
option-pane	
toolbar-component
tree-view

Initargs  
:interaction  
The interaction style of the choice.
:selection  
The indexes of the choice’s selected items.
:selected-item  
The selected item for a single selection choice.
:selected-items  
A list of the selected items.
:keep-selection-p  
If t, retains any selection when the items change.
The class choice inherits most of its behavior from collection, and then provides the selection facilities itself. The classes list-panel, button-panel, option-pane, menu-component and graph-pane inherit from it, and so it plays a key role in CAPI applications.

A choice can have one of four different interaction styles, and these control how it behaves when an item is selected by the user. interaction can be one of:

:no-selection The choice behaves just as a collection.
:single-selection The choice can have only one selected item.
:extended-selection An alternative to multiple-selection.

With interaction :no-selection, the choice cannot have a selection, and so behaves just as a collection would.

With interaction :single-selection, the choice can only have one item selected at a time. When a new selection is made, the old selection is cleared and its selection-callback is called. The selection-callback is also called when the user invokes the selection gesture on the selected item.
With \textit{interaction} \texttt{:multiple-selection}, the choice can have any number of items selected, and selecting an item toggles its selection status. The \textit{selection-callback} is called when an item becomes selected, and the \textit{retract-callback} is called when an item is deselected. \texttt{:multiple-selection} is not supported for lists on Mac OS X.

With \textit{interaction} \texttt{:extended-selection}, the choice can have any number of items selected as with \texttt{:multiple-selection} interaction, but the usual selection gesture removes the old selection. However, there is a window system-specific means of extending the selection. When an item is selected the \textit{selection-callback} is called, when the selection is extended the \textit{extend-callback} is called, and when an item is deselected the \textit{retract-callback} is called.

On Mac OS X, the selection gesture is mouse (left button) click. Deselection and discontinuous selections are made by \texttt{Command+Click}, and a continuous selection is made by \texttt{Shift+Click}, regardless of whether \textit{interaction} is \texttt{:multiple-selection} or \texttt{:extended-selection}.

The choice's selection stores the indices of the currently selected item, and is a single number for single selection choices and a list for all other interactions. Therefore when calling \texttt{(setf choice-selection)} you must pass an integer or \texttt{nil} if \textit{interaction} is \texttt{:single-selection}, and you must pass a list of integers if \textit{interaction} is \texttt{:multiple-selection} or \texttt{:extended-selection}. The functions \texttt{choice-selected-item} and \texttt{choice-selected-items} treat the selection in terms of the items themselves as opposed to their indices.

Usually when a choice's items are changed using \texttt{(setf collection-items)} the selection is lost.

However, if the choice was created with \texttt{:keep-selection-p}, then the selection is preserved over the change.

\textit{initial-focus-item}, if supplied, specifies the item which has the input focus when the choice is first displayed.
Notes

When calling \texttt{(setf choice-selection)} you must pass an integer or \texttt{nil} when \texttt{interaction} is \texttt{:single-selection}. You must pass a list for other values of \texttt{interaction}.

Compatibility note

In LispWorks 5.0 and earlier versions, for interaction \texttt{:single-selection} the \texttt{selection-callback} is called only after a new selection is made.

Example

The following example defines a choice with three possible selections.

\begin{verbatim}
(setq choice (make-instance 'capi:choice
   :items '("One" "Two" "Three")
   :selection 0))

(capi;display-message "Selection: -S"
 (capi:choice-selection choice))

(capi:choice-selected-item choice)
\end{verbatim}

The selection is changed using the following code.

\begin{verbatim}
(setf (capi:choice-selection choice) 1)

(capi:choice-selected-item choice)
\end{verbatim}

Also see these examples:

\begin{verbatim}
(example-edit-file "capi/choice/*")

(example-edit-file "capi/graphics/graph-pane")
\end{verbatim}

See also

\texttt{choice-selected-item}

\texttt{choice-selected-item-p}

\texttt{choice-selected-items}

\texttt{choice-update-item}

\texttt{redisplay-collection-item}

\texttt{remove-items}

\texttt{replace-items}

Chapter 5, "Choices - panes with items"
The function `choice-selected-item` returns the currently selected item in a single selection choice.

**Package**
capi

**Signature**
`choice-selected-item choice`

**Signature**
`(setf choice-selected-item) item choice`

**Description**
The function `choice-selected-item` returns the currently selected item in a single selection choice. A `setf` method is provided as a means of setting the selection. Note that the items are compared by `choice`'s test-function - see `collection` or the example below.

It is an error to call this function on choices with different interactions — in that case, you should use `choice-selected-items`.

**Example**
This example illustrates setting the selection. First we set up a single selection choice — in this case, a `list-panel`.

```lisp
(setq list (capi:contain
(capi:make-instance 'capi:list-panel
:items '(a b c d e)
:selection 2))
```

The following code line returns the selection of the list panel.

```lisp
(capi:choice-selected-item list)
```

The selection can be changed, and the change viewed, using the following code.

```lisp
(capi:apply-in-pane-process
list #'(setf capi:choice-selected-item) 'e list)
```

```lisp
(capi:choice-selected-item list)
```
This example illustrates the effect of the `test-function`. Make a choice with `test-function cl:eq`:

```lisp
(setq *list*
  (capi:contain
   (make-instance 'capi:list-panel
     :items (list "a" "b" "c")
     :selection 0
     :visible-min-height :text-height)))
```

This call loses the selection since `(eq "b" "b")` fails:

```lisp
(capi:apply-in-pane-process
 *list* #'(setf capi:choice-selected-item)
 "b* *list*)
```

Change the test function:

```lisp
(capi:apply-in-pane-process
 *list* #'(setf capi:collection-test-function)
 'equal *list*)
```

This call sets the selection since `(equal "b" "b")` succeeds:

```lisp
(capi:apply-in-pane-process
 *list* #'(setf capi:choice-selected-item)
 "b* *list*)
```

See also

- `choice`
- `choice-selected-item-p`
- `choice-selected-items`
- `collection`
- Chapter 5, “Choices - panes with items”

### choice-selected-item-p

**Function**

**Summary**
Checks if an item is currently selected in a choice.

**Package**
capi

**Signature**
`choice-selected-item-p choice item => result`
Arguments

choice A choice.
item An item.

Values

result A boolean.

Description

The function choice-selected-item-p is the predicate for whether an item item of the choice choice is selected.

Note that the items are compared by choice’s test-function - see collection for details.

Example

(setq list              (capi:contain
    (make-instance 'capi:list-panel
        :items '(a b c d)
        :selection 2
        :visible-min-height
            '(':character 4)))))

(capi:choice-selected-item-p list 'c)
=>
t

Now click on another item.

(capi:choice-selected-item-p list 'c)
=>
nil

See also

choice

choice-selected-items

Generic Function

Summary

The function choice-selected-items returns the currently selected items in a choice as a list of the items.

Package
capi

Signature

choice-selected-items choice => items
Signature

\[(setf choice-selected-items) \text{ items choice } \rightarrow \text{ item}\]

Arguments

\text{choice} \quad \text{A choice.}

Values

\text{items} \quad \text{A list of items.}

Description

The function \text{choice-selected-items} returns the currently selected items in a choice as a list of the items. A \text{setf} method is provided as a means of setting the currently selected items. Note that the items are compared by \text{choice's test-function} - see \text{collection} for details.

In the case of \text{:single-selection} choices, it is usually easier to use the complementary function \text{choice-selected-item}, which returns the selected item as its result.

Example

First we set up a \text{:multiple-selection} choice — in this case, a list panel.

\begin{verbatim}
(setq list (capi:contain
  (make-instance
    'capi:list-panel
    :items '(a b c d e)
    :visible-min-height '(:character 5)
    :interaction :multiple-selection
    :selection '(1 3))))
\end{verbatim}

The following code line returns the selections of the list.

\begin{verbatim}
(capi:choice-selected-items list)
\end{verbatim}

The selections of the list panel can be changed and redisplayed using the following code.

\begin{verbatim}
(capi:apply-in-pane-process
  list #'(setf capi:choice-selected-items)
  '(a c e) list)
\end{verbatim}

\begin{verbatim}
(capi:choice-selected-items list)
\end{verbatim}

Note that \text{interaction :multiple-selection} is not supported for lists on Mac OS X.
See also
choice
choice-selected-item
choice-selected-item-p
choice-selected-items
collection
Chapter 5, “Choices - panes with items”

**choice-update-item**

*Function*

Summary
Updates an item in a choice.

Package
capi

Signature
choice-update-item choice item

Arguments
choice A choice.
item An item.

Description
The function choice-update-item updates the display of the item item in the choice choice. It should be called if the display of item (that is, the string returned by the print-function) changes.

Examples
Create a list panel that displays the status of something

(defun my-print-an-item (item)
   (format nil "~a: ~a"
           (substitute-if-not #\space #\space
                            (alphanumericp
                             (symbol-name item)))
           (symbol-value item)))

(defvar *status-one* :on)
(defvar *status-two* :off)
(setq list
  (capi:contain
   (make-instance
    'capi:list-panel
    :items '(*status-one* *status-two*)
    :print-function 'my-print-an-item
    :visible-min-height :text-height
    :visible-min-width :text-width)))

Setting the status variables does not change the display:

(setq *status-one* :error)

Update the item to change the display:

(capi:choice-update-item list '*status-one*)

This example also demonstrates choice-update-item:

(example-edit-file "capi/choice/alternative-action-callback")

See also choice

---

**clipboard**

*Function*

**Summary**

Returns the contents of the system clipboard.

**Package**

capi

**Signature**

clipboard self &optional format => result

**Arguments**

self A displayed CAPI pane or interface.

format A keyword.

**Values**

result A string, an image, a Lisp object, or nil.

**Description**

The function clipboard returns the contents of the system clipboard as a string, or nil if the clipboard is empty.
format controls what kind of object is read. The following values of format are recognized:

:string The object is a string. This is the default value.
:image The object is of type image, converted from whatever format the platform supports.
:value The object is the Lisp value.
:metafile The object is a metafile.

When format is :image, the image returned by clipboard is associated with self, so you can free it explicitly with free-image or it will be freed automatically when the pane is destroyed.

When format is :metafile the object is a metafile which should be freed using free-metafile when no longer needed. See also draw-metafile and draw-metafile-to-image. format :metafile is not supported on GTK+ or X11/Motif.

The Microsoft Windows clipboard is usually set by the user with the Ctrl+C and Ctrl+X gestures. Note that the LispWorks editor uses these gestures when in Windows emulation mode.

On X11/Motif, various gestures may set the clipboard. Note that LispWorks uses Ctrl+C and Ctrl+X when in KDE/Gnome editor emulation mode. The X clipboard can also be accessed by running the program xclipboard or the Emacs function x-get-clipboard.

The Mac OS X clipboard is usually set by the user with the Command+C and Command+X gestures.

See also

clipboard-empty
draw-metafile
draw-metafile-to-image
free-image
clipboard-empty

Function

Summary
Determines whether the system clipboard contains an object of the specified kind.

Package
capi

Signature
clipboard-empty self &optional format => result

Arguments
self A displayed CAPI pane or interface.
format A keyword.

Values
result t or nil.

Description
The function clipboard-empty returns nil if there is an object of the kind indicated by format on the clipboard, or t otherwise.

format controls what kind of object is checked. The allowed values of format are as described for clipboard.

See also
clipboard
image
“Clipboard” on page 265

clone

Generic Function

Summary
Creates a copy of a CAPI object.
Package  capi
Signature  \texttt{clone} \texttt{capi-object} \Rightarrow \texttt{cloned-object}
Arguments  \texttt{capi-object} \quad \text{An instance of a subclass of} \texttt{capi-object}
Values  \texttt{cloned-object} \quad \text{A copy of} \texttt{capi-object}.
Description  The generic function \texttt{clone} returns a new object \texttt{cloned-object} which is a copy of \texttt{capi-object}. It does not share any data with \texttt{capi-object}, but has a copy of the useful part of its state.
The system contains methods on \texttt{clone}. You may add methods on your own interface classes.
See also  \texttt{capi-object}

\textbf{cocoa-default-application-interface}

\textit{Class}

Summary  The class supporting application menus and message processing for a Cocoa application.

Package  capi
Superclasses  interface
Initargs  
  \texttt{:message-callback}
  \hspace{1em} A function or \texttt{nil}.
  \texttt{:application-menu}
  \hspace{1em} \texttt{nil}, a \texttt{menu}, or the name of a slot containing a \texttt{menu} in the application interface.
  \texttt{:dock-menu} \quad \texttt{nil}, a \texttt{menu}, or a function designator.
Accessors  application-interface-message-callback
            application-interface-application-menu
            application-interface-dock-menu
Description

The class `cocoa-default-application-interface` supports the application menu, application messages and other functionality for a Cocoa application.

All Cocoa applications in LispWorks for Macintosh have an application interface, which is a hidden interface that provides the following:

1. The application menu (the leftmost menu in the menu bar, named after the application). See `application-menu` below.
2. The menu bar items that are displayed when no other interfaces are on the screen. See `menu-bar-items` in `interface` and `menu-bar` in `define-interface`.
3. An optional Dock context menu. See `dock-menu` below.
4. Optional application message processing. See `message-callback` below.
5. Control over the lifecycle and `display-state` of the application as a whole.

If you wish to override the defaults, then you should first define a subclass of `cocoa-default-application-interface` with your changes. Then set a single instance of this subclass as the application interface by calling `set-application-interface` before any CAPI functions that make the screen object (such as `convert-to-screen` and `display`).

Do not call `display` with a subclass of `cocoa-default-application-interface` - the application interface does not have a window on the screen and should be created in addition to the visible interfaces in your application.

When non-nil, `message-callback` should be a function with signature

```
interface message &rest args
```
message-callback will be called for various application messages. The interface argument will be the application interface and the message argument will be a keyword. The message argument will be one of the following:

**:open-file**
This message is invoked when the user double-clicks on a document associated with the application or drags a document into the application icon. The args contain the name of the file to open.

**:finished-launching**
This message is invoked just after the user has started the application and all other initialization has been done (including any :open-file message if applicable). You can use it to open a default document for example. There are no args.

application-menu controls the application’s main menu. If this is nil, then a minimal application menu will be made using the title of the application interface, otherwise it should be a menu containing the usual items or the name of a slot containing such a menu in the application interface. Note that the Quit item in the application-menu needs to call destroy on the interface, rather than call lw:quit.

dock-menu provides a menu for use by the Mac OS X Dock icon. If the value is nil (the default), then the standard menu is used. If dock-menu is a function designator, it is called with the application interface as its argument when the menu is popped up and should return a menu. Otherwise dock-menu should be a menu, which is used directly. The Dock will add the standard items such as Quit to the end of the menu you supply.

interface initargs are interpreted as follows:

- The activate-callback is called when the application is activated or deactivated.
The create-callback is called when the application starts up.

The destroy-callback is called when the application shuts down.

The confirm-destroy-function is called to confirm whether the application should shut down.

All of these callbacks execute in the thread that runs the Cocoa event loop, so they can call CAPI and GP functions.

The application interface also allows you to control aspects of the application. In particular:

- The function destroy will cause the application to shut down.

- The function top-level-interface-display-state will return :hidden if the whole application is hidden and will return :normal otherwise.

- The function (setf top-level-interface-display-state) can be used to perform some operations typically found on the application menu.

The display-state value can one of:

: normal Show the application and activate it
:restore Show the application again without activating it
:hidden Hide
:others-hidden Hide Others
:all-normal Show All

Notes cocoa-default-application-interface is implemented only in LispWorks for Macintosh with the Cocoa IDE.

Examples (example-edit-file "capi/applications/cocoa-application")
cocoa-view-pane

Class

Summary
Allows an arbitrary Cocoa view class to be used on the Macintosh.

Package
capi

Superclasses
simple-pane
titled-object

Initargs
:view-class A string naming the view class to use.
:init-function A function that initializes the view class.

Accessors
cocoa-view-pane-view-class
cocoa-view-pane-init-function

Description
The class cocoa-view-pane allows an instance of an arbitrary Cocoa view class to be displayed within a CAPI interface.

When the pane becomes visible, the CAPI allocates and initialize a Cocoa view object using the initargs as follows:
If `view-class` is specified, then it should be a string naming the Cocoa view class to allocate. Otherwise the class `NSView` is allocated.

If `init-function` is not `nil`, then it should be a function which is called with of two arguments, the pane and a foreign pointer to the newly allocated Cocoa view object. The function should initialize the Cocoa view object in whatever way is required, including invoking the appropriate Objective-C initialization method, and return the initialized view. If `init-function` is `nil` then the Objective-C method `init` is called and the result is returned.

After the Cocoa view has been initialized, the function `cocoa-view-pane-view` can be used to retrieve it.

You can use the functions `(setf cocoa-view-pane-view-class)` and `(setf cocoa-view-pane-init-function)` to modify the `view-class` and `init-function`, but the values will be ignored if this is done after the pane becomes visible.


Notes

cocoa-view-pane is implemented only in LispWorks for Macintosh with the Cocoa IDE.

Example

The following code uses `cocoa-view-pane` to display an `NSMovieView` displaying an existing movie.

```lisp
(defun show-movie (movie)
  (capi:contain
   (make-instance 'cocoa-view-pane
                  :view-class "NSMovieView"
                  :init-function
                  #'(lambda (pane view)
                     (setq view
                           (objc:invoke view "init")))
                           (objc:invoke view "setMovie:" movie)
                           view))))
```
cocoa-view-pane-view

Function

Summary
Returns the Cocoa view of a cocoa-view-pane.

Package
capi

Signature
cocoa-view-pane-view pane => view

Arguments
pane A cocoa-view-pane.

Values
view A foreign pointer to a Cocoa view or nil.

Description
The function cocoa-view-pane-view returns the Cocoa view for the cocoa-view-pane pane as a foreign pointer. This view is only accessible when the pane is visible and nil is returned in other cases.

Notes

Example
(example-edit-file "objc/movie-view")

See also
cocoa-view-pane
“Special kinds of windows” on page 28
Signature  
\texttt{collect-interfaces \ proto \ &key \ screen \ current-process-first \ sort-by \ => \ interfaces}

Arguments  
\texttt{proto}  
A class, class name, or an interface.

\texttt{screen}  
\texttt{nil}, the symbol \texttt{:any}, a screen, or a keyword naming a library.

\texttt{current-process-first}  
A boolean.

\texttt{sort-by}  
\texttt{:visible} or \texttt{:create}.

Values  
\texttt{interfaces}  
A list.

Description  
The generic function \texttt{collect-interfaces} returns a list of CAPI interfaces which are instances of the class indicated by \texttt{proto}, or subclasses thereof.

If screen is \texttt{nil}, the interfaces on the default screen are returned. This is the default. If screen is \texttt{:any}, interfaces includes those on any screen. If screen is a \texttt{screen} object, the interfaces on that screen are returned. screen can also be a library name, currently the accepted values are \texttt{:win32}, \texttt{:motif} and \texttt{:cocoa}.

If interfaces on multiple screens are returned, then those on each screen are grouped together in \texttt{interfaces}.

Amongst those for each screen, the interfaces are grouped as follows. If \texttt{current-process-first} is true, then the interfaces in the current process appear together at the beginning of the group. If \texttt{sort-by} is \texttt{:create} then these interfaces are sorted by creation time, otherwise \texttt{sort-by} is \texttt{:visible} and they are are sorted in Z-order. The interfaces of other processes appear at the end of the group, also sorted according to \texttt{sort-by}.

If \texttt{current-process-first} is \texttt{nil}, then the interfaces for each screen are sorted according to \texttt{sort-by}.

The default value of \texttt{sort-by} is \texttt{:create} and of \texttt{current-process-first} is \texttt{t}.
collection

Class

Summary
A collection collects together a set of items, and provides functionality for accessing and displaying them.

Package
capi

Superclasses
capi-object
callbacks

Subclasses
choice

Initargs
:items The items in the collection.

:print-function
A function that prints an item.

:test-function
A comparison function between two items.

:items-count-function
A function which returns the length of items.

:items-get-function
A function that returns the nth item.

:items-map-function
A function that maps a function over the items.

:accepts-focus-p
Specifies that the collection should accept input. The default value is t.

:help-key
An object used for lookup of help.
The main use of `collection` is as a part of the class `choice`, which provides selection capabilities on top of the collection handling, and which is used by list panels, button panels and menus amongst others.

The items in the collection are printed by `print-collection-item`.

Items can be instances of the CAPI class `item` or any Lisp object. The main difference is that non-CAPI items use the callbacks specified for the collection, while the CAPI items will use their callbacks in preference if these are specified.

By default, `items` must be a sequence, but this can be changed by specifying `items-get-function`, `items-count-function`, and `items-map-function`.

`items-get-function` should take as arguments the items and an index, and should return the indexed item. The default is `svref`.

`items-count-function` should take the items as an argument and should return the number of them.

`items-map-function` should take as arguments the items, a function `function` and a flag `collect-results-p`, and should call `function` on each of the items in turn. If `collect-results-p` is non-nil, then it should also return the results of these calls in a list.
test-function should be suitable for comparing the items in your collection, returning a boolean. For example, if there are both strings and integers amongst your items, you should supply test-function cl:equal. The default value of test-function is cl:eq.

You can change the items using (setf collection-items). Note that there is an optimization append-items that is sometimes useful when adding items.

accepts-focus-p and help-key are interpreted as described in element.

Example

The following code uses push-button-panel, a subclass of collection.

(capi:contain (make-instance 'capi:push-button-panel :items '(one two three)))

(capi:contain (make-instance 'capi:push-button-panel :items '(one two three) :print-function 'string-capitalize))

The following example provides a collection with all values from 1 to 6 by providing an items-get-function and an items-count-function.

(capi:contain (make-instance 'capi:push-button-panel :items 6 :items-get-function #'(lambda (items index) (1+ index)) :items-count-function #'(lambda (items) items)))

Here is an example demonstrating the use of CAPI items in a collections list of items to get more specific callbacks.
(defun specific-callback (data interface)
  (capi:display-message "Specific callback for ~S" data))

(defun generic-callback (data interface)
  (capi:display-message "Ordinary callback for ~S" data))

(capi:contain (make-instance
  'capi:list-panel
  :items (list (make-instance
  'capi:item
  :text "Special"
  :data 1000
  :selection-callback
  'specific-callback)
  2 3 4)
  :selection-callback 'generic-callback)
  :visible-min-width 200
  :visible-min-height 200)

See also
append-items
count-collection-items
get-collection-item
item
map-collection-items
print-collection-item
search-for-item
“Tooltips” on page 35
Chapter 5, “Choices - panes with items”

collection-find-next-string

Generic Function

Summary
Finds the next occurrence of the string that was previously searched for in a collection.

Package
capi

Signature
collection-find-next-string collection &key set => index

Arguments
collection A collection.
The generic function `collection-find-next-string` must be called after one of `collection-search`, `collection-find-string` or `find-string-in-collection` was called on `collection`. It searches for the next item in `collection` with printed representation matching the last string searched for and returns its index, or `nil` if no match is found.

If `set` is true, then if an item matching the string is found, the selection is set to this item. `set` defaults to `t`.

**See also**

- `collection-find-string`
- `collection-last-search`
- `find-string-in-collection`

---

**collection-find-string**

*Generic Function*

**Summary**

Finds the next occurrence of a string in a collection, prompting for the string if it is not supplied.

**Package**

capi

**Signature**

`collection-find-string collection &key set string => index`

**Arguments**

- `collection` A collection.
- `set` A boolean.
- `string` A string, or `nil`.

**Values**

- `index` A non-negative integer or `nil`.

**Description**

The generic function `collection-find-string` calls `find-string-in-collection` with `collection` and `set`.
string is also passed if non-nil. If string is nil, collection-find-string first prompts the user for a string to pass. set defaults to t.

See also find-string-in-collection

collection-last-search

Generic Function

Summary Returns the last string searched for in a collection.

Package capi

Signature collection-last-search collection => string

Arguments collection A collection.

Values string A string, or nil.

Description The generic function collection-last-search returns the last string searched for in collection by find-string-in-collection. If neither of these functions has been called on collection, then the return value string is nil.

See also find-string-in-collection

collection-search

Generic Function

Summary The generic function collection-search calls find-string-in-collection with a string provided by the user.

Package capi
Signature  collection-search  collection  &optional  set

Description  Prompts the user for a string and calls find-string-in-collection with collection, set and this string.

  set defaults to t.

Notes  collection-search is deprecated. Use collection-find-string instead.

See also  collection
collection-find-string
find-string-in-collection

**collector-pane**  Class

Summary  A collector-pane is an editor-pane which displays the output sent to a particular type of character stream called an editor stream, the contents of which are stored in an editor buffer.

Package  capi

Superclasses  editor-pane

Initargs  :buffer-name  The name of a buffer onto an editor stream.
            :stream  The editor stream to be collected.

Readers  collector-pane-stream

Description  A new collector-pane can be created to view an existing editor stream by passing the stream itself or by passing the buffer name of that stream.
To create a new stream, either specify `buffer-name` which does not match any existing buffer, or do not pass `buffer-name` in which case the CAPI will create a unique buffer name for you.

To access the stream, use the reader `collector-pane-stream` on the `collector-pane`.

Note that the editor buffer “Background Output” is a buffer onto the output stream `*standard-output*`.

**Example**

Here is an example that creates two collector panes onto a new stream (that is created by the first collector pane).

```lisp
(setq collector (capi:contain
  (make-instance 'capi:collector-pane)))

(setq *test-stream*
  (capi:collector-pane-stream collector))

(capi:contain
  (make-instance 'capi:collector-pane
    :stream *test-stream*))

(format *test-stream* "Hello World~%")
```

Finally, this example shows how to create a collector pane onto the “Background Output” stream.

```lisp
(capi:contain (make-instance 'capi:collector-pane
  :buffer-name "Background Output"))
```

See also

- `with-random-typeout`
- `map-typeout`
- `unmap-typeout`
- “Stream panes” on page 30

---

**color-screen**

*Class*

Package `capi`

Superclasses `screen`
Description
This is a subclass of screen that gets created for color screens. It is primarily available as a means of discriminating on whether or not to use colors in an interface.

See also
element-screen
mono-screen

**column-layout**

**Class**

**Summary**
A layout which arranges its children in a column.

**Package**
capi

**Superclasses**
grid-layout

**Initargs**
:ratios The size ratios between the layout’s children.
:adjust The horizontal adjustment for each child.
:gap The gap between each child.
:uniform-size-p
If t, each child in the column has the same height.

**Accessors**
layout-ratios

**Description**
The class column-layout lays its children out in a column. It inherits the behavior from grid-layout. The description is a list of the layout’s children, and the layout also translates the initargs ratios, adjust, gap and uniform-size-p into the grid-layout’s equivalent initargs y-ratios, x-adjust, y-gap and y-uniform-size-p.
**description** may also contain the keywords :**divider** and :**separator** which automatically create a divider or separator as a child of the column-layout. The user can move a divider, but cannot move a separator.

When specifying :**ratios** in a row with :**divider** or :**separator**, you should use **nil** to specify that the divider or separator is given its minimum size, as in the example below.

**Compatibility note**

*layout-divider-default-size* and column-layout-divider are not supported in LispWorks 4.4 and later.

**Example**

```
(capi:contain (make-instance 'capi:column-layout
  :description
  (list
    (make-instance 'capi:push-button
      :text "Press me")
    "Title"
    (make-instance 'capi:list-panel
      :items '(1 2 3))))
```
(setq column (capi:contain
    (make-instance 'capi:column-layout
        :description (list
            (make-instance 'capi:push-button
                :text "Press me")
            "Title:"
            (make-instance 'capi:list-panel
                :items '(1 2 3))
            :adjust :center)))
    (capi:apply-in-pane-process column #'(setf capi:layout-x-adjust) :right column)
    (capi:apply-in-pane-process column #'(setf capi:layout-x-adjust) :left column)
    (capi:apply-in-pane-process column #'(setf capi:layout-x-adjust) :center column)
    (flet ((make-list-panel (x y)
            (make-instance 'capi:list-panel
                :items (loop for i below x collect i)
                :selection (loop for i below x by y collect i)
                :interaction :multiple-selection)))
        (capi:contain
            (make-instance 'capi:column-layout
                :description (list
                    (make-list-panel 100 5)
                    :divider
                    (make-list-panel 100 10))
                :ratios '(1 nil 2))))
    See also row-layout
    "CAPI elements" on page 2
    "Button panel classes" on page 44
Chapter 6, “Laying Out CAPI Panes”
Chapter 7, “Programming with CAPI Windows”
Chapter 10, “Defining Interface Classes - top level windows”

**component-name**

**Function**

**Summary**

Gets and sets the `component-name` of an `ole-control-pane`.

**Package**

`capi`

**Signature**

`component-name pane => name`

`(setf component-name) name pane => name`

**Description**

The function `component-name` accesses the `component-name` of an `ole-control-pane`.

When the `ole-control-pane` is created, it automatically opens the component and inserts it.

If `(setf component-name)` is called on a pane that is already created, any existing component is closed, and the new component is opened and inserted. `(setf component-name)` also sets the pane’s `user-component` to `nil`.

**Notes**

`component-name` is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

**See also**

`ole-control-pane`

**confirm-quit**

**Function**

**Summary**

Quits the Lisp session, potentially after user confirmation.

**Package**

`capi`

**Signature**

`confirm-quit application-name`
## Arguments

| application-name | A string. |

## Description

The function **confirm-quit** calls **quit**, potentially after confirmation from the user.

The behavior of **confirm-quit** when called within LispWorks is determined by a LispWorks user preference, which can be set by **Tools > Preferences... > Environment > General > Confirm Before Exiting**. This preference can also be set programmatically (for example in an application) by **set-confirm-quit-flag**.

If the value of the flag is **:check-editor-files** (the default), **confirm-quit** checks whether there are editor buffers which are associated with files and are modified. If there is at least one such modified buffer, **confirm-quit** prompts the user to decide between three options:

- **Save Changes** Saves all modified buffers before quitting
- **Discard Changes** Quits without saving
- **Cancel** Does not save or quit

If there are no such modified buffers, **confirm-quit** simply calls **quit**.

If the flag is **nil** then **confirm-quit** simply calls **quit**.

If the flag is **t** then **confirm-quit** prompts the user. If there are unsaved buffers, the prompt is as described above, otherwise the prompt is a simple yes/no confirmmer dialog.

**application-name** is used in the prompt to identify the application.

## Notes

The LispWorks IDE uses **confirm-quit**.

## See also

**set-confirm-quit-flag**
**confirm-yes-or-no**

*Function*

**Summary**
The function confirm-yes-or-no pops up a dialog button containing a message and a Yes and No button.

**Package**
capi

**Signature**
confirm-yes-or-no format-string &rest format-args

**Description**
This pops up a dialog box containing a message and the buttons Yes and No, returns t when the Yes button is clicked, and nil when the No button is clicked. The message is obtained by applying the format-string and the format-args to the Common Lisp function format.

This function is actually a convenient version of prompt-for-confirmation, but has the disadvantage that you cannot specify any customization arguments. For more flexibility, use prompt-for-confirmation itself.

**Example**
```lisp
(setq pane (capi:contain (make-instance 'capi:text-input-pane) :title "Test Interface"))

(when (capi:confirm-yes-or-no "Close -S?" pane)
   (capi:apply-in-pane-process pane 'capi:quit-interface pane))
```

See also
- prompt-for-confirmation
- display-dialog
- popup-confirmer
- Chapter 11, “Dialogs: Prompting for Input”

**confiner-pane**

*Function*

**Summary**
Returns the pane associated with a confirmer interface.

**Package**
capi
Signature  

`confirmer-pane interface => pane`

Arguments  

`interface` A confirmer interface displayed by `popup-confirmers`.

Values  

`pane` The `pane` argument passed to `popup-confirmers`.

Description  

The function `confirmer-pane` returns the pane associated with a confirmer interface that has been displayed by `popup-confirmers`.

In most cases the programmer does not have access to this interface, but it can be passed to the confirmer’s callbacks when extra buttons are added via the `buttons` argument.

See also  

`popup-confirmers`

**contain**

*Function*

Summary  

Displays a window containing an element.

Package  

`capi`

Signature  

`contain element &rest interface-args &key screen process title as-dialog &allow-other-keys => element`

Arguments  

`element` A CAPI `element`.

`screen` A screen, or any argument accepted by `convert-to-screen`.

`process` On GTK+, Microsoft Windows or Motif, a CAPI process, `t` or `nil`. On Cocoa, this argument is not supported.

`title` A string.

`as-dialog` A generalized boolean.
The function \texttt{contain} creates and displays a container for the CAPI element \texttt{element}. \texttt{contain} returns \texttt{element} as its result. \texttt{contain} is provided as a convenient way of testing CAPI functionality and is useful mainly during interactive development. Many of the CAPI examples use it.

The container is created using \texttt{make-container}, which can make containers for any of the following classes:

\begin{verbatim}
    simple-pane
    layout
    interface
    pinboard-object
    menu
    menu-item
    menu-component
    cl:list
\end{verbatim}

In the case of a \texttt{cl:list}, the CAPI tries to see what sort of objects they are and makes an appropriate container. For instance, if they were all \texttt{simple-panes} it would put them into a \texttt{column-layout}.

\texttt{interface-args}, after removing the arguments \texttt{screen} and \texttt{process}, are passed to \texttt{make-container} as the initargs to the interface. \texttt{title} is used as the title of the container.

\texttt{as-dialog} can be \texttt{nil}, \texttt{t} or :\texttt{no-escape-button}. The default value of \texttt{as-dialog} is \texttt{nil}, which means display the interface as an ordinary window using \texttt{display}. When \texttt{as-dialog} is true it displays using \texttt{display-dialog}. When \texttt{as-dialog} is \texttt{t}, \texttt{contain} adds to the interface an escape button which invokes \texttt{abort-dialog}, to ensure that the user does not get stuck with a dialog that cannot be dismissed. When \texttt{as-dialog} is :\texttt{no-escape-button}, it does not add the escape button. Any value of \texttt{as-dialog} has the same effect as \texttt{t}.

The values of the arguments \texttt{screen} and \texttt{process} are passed to \texttt{display} when displaying the container.
Example

(capi:contain (make-instance 'capi:text-input-pane))

(capi:contain (make-instance 'capi:column-layout
    :description "Title:" (make-instance 'capi:text-input-pane))))

(capi:contain (make-instance 'capi:menu-item
    :title "Test")

See also

make-container
display
display-dialog
element

Chapter 2, “Getting Started”
“The correct thread for CAPI operations” on page 39
Chapter 12, “Creating Panes with Your Own Drawing and Input”

convert-relative-position

Summary

Converts a screen position from one coordinate system to another.

Package
capi

Signature

convert-relative-position from to x y => to-x, to-y

Arguments

from A pane, interface or screen.
to A pane, interface or screen.
x An integer.
y An integer.

Values

to-x An integer.
to-y An integer.
The function `convert-relative-position` converts the position \( x, y \) in the coordinate system of `from` to that of `to`.

**Example**

```
(example-edit-file "capi/elements/convert-relative-position")
```

**See also**

- `top-level-interface-geometry`
- `with-geometry`

---

## convert-to-screen

**Summary**

Finds the appropriate screen or container for a CAPI object.

**Package**

capi

**Signature**

`convert-to-screen &optional object => result`

**Arguments**

- `object`
  
  A CAPI object, a plist, or keyword or `nil`

**Values**

- `result`
  
  A screen or a container.

**Description**

The function `convert-to-screen` finds the appropriate screen or container for the CAPI object `object`.

If `object` is `nil`, `result` is the default screen. `object` defaults to `nil`.

If `object` is a pane inside a MDI interface, then `result` is the `capi:container` of the interface, rather than the real screen, because this is more useful in most cases. To obtain the real screen, call `convert-to-screen` on the top level interface. See `document-frame` for a description of MDI interfaces.

`object` can be a keyword representing the CAPI library. This is equivalent to using the `:library` key in the plist case below. `object` can also be the special keyword `:if-any`, which finds a screen if there is any active screen, otherwise it returns `nil`.

---

374
object can be a plist. The keys below are supported on GTK+ and Motif. Other libraries ignore them.

- **:display** The value is an X Window System display string describing the X display and screen to use. The default value is derived from the DISPLAY environment variable or (on Motif) the -display command-line option, or (on GTK+) the --display command-line option. If neither is supplied, the default is to use the default screen on the local host.

- **:host** The name of the host to use for the X Window System display. This key is valid only if no :display key/value is supplied. The default value is the local host.

- **:server-number** The number of the display server to use for the X Window System display. This key is valid only if no :display key/value is supplied. The default value is 0.

- **:screen-number** The number of the screen to use for the X Window System display. This key is valid only if no :display key/value is supplied. The default value is the default screen of the display.

- **:application-class** The value is a string naming the application class used for X Window System resources. The default value is "Lispworks". When running a delivered LispWorks image, you should specify the :application-class key if you want to provide application-specific resources.

On GTK+ the value is used for constructing the default widget-name for top-level interfaces. The application-class is prepended to the interface name followed by a ":", so if
application-class is "my-application", a top-level-interface of class my-interface will have a default widget-name "my-application.my-interface".

See element for the description of widget-name.

Example GTK+ resource files are in lib/7-0-0-0/examples/gtk/

:fallback-resources
On GTK+ the fallback resources are global, so they cannot be used to define different resources for different screens. Each call to convert-to-screen where fallback-resources is passed overrides the previous call. The value of fallback-resources is either a single string or a list of strings. In either case each string must be a complete specification according to the standard resource specification of GTK+ resource files (gtk_rc_parse_string should be able to parse it).

On Motif the value is a list of strings representing the set of application context fallback resources to use (see XtAppSetFallbackResources). Each string corresponds to a single line of an X resource file.

:library
The value specifies the CAPI library. This is useful on Linux, FreeBSD, AIX and x86/x64 Solaris platforms, and in the Mac OS X/GTK+ image, to choose between :gtk and :motif if the deprecated "capi-motif" module is loaded.

This keys is supported on Motif only. Other libraries ignore it.
:command-line-args

The value is a list of strings representing the set of command-line arguments to pass to XtOpenDisplay. Each string corresponds to a single argument. The default value is derived from the command line used to start Lisp.

The resources are used only when no other system resource files can be found. When running a non-delivered LispWorks image, the default value of the :fallback-resources key is read from the file whose name is the value of the :application-class key in the app-defaults directory of the current LispWorks library. When running a delivered LispWorks image, you should specify the :fallback-resources key if your application needs fallback resources.

Example

(capi:convert-to-screen)

See also
document-frame
screen
Chapter 19, "Host Window System-specific issues"

count-collection-items

Generic Function

Summary
Returns the number of items in a collection.

Package
capi

Signature
count-collection-items collection &optional representation

Description
The generic function count-collection-items returns the number of items in collection by calling the items-count-function.

representation defaults to nil. If it is non-nil, it is used instead of the items of collection.
Example

The following example uses `count-collection-items` to return the number of items in a list panel.

```
(setq list (make-instance 'capi:list-panel
    :items '(1 2 3 4 5)))

(capi:count-collection-items list)
```

The following example shows how to count the number of items in a specified list.

```
(capi:count-collection-items list '(1 2))
```

See also

- `collection`
- `get-collection-item`
- `search-for-item`

---

**create-dummy-graphics-port**

*Function*

**Summary**

Creates a graphics port object that can be used for querying fonts and measuring text or images.

**Package**

capi

**Signature**

`create-dummy-graphics-port &optional screen => graphics-port`

**Arguments**

`screen`

A value suitable as the argument to `convert-to-screen`.

**Values**

`graphics-port`

A graphics port.

**Description**

The function `create-dummy-graphics-port` creates a graphics port object that can be used for font queries, measuring text and images.
graphics-port is a graphics port object associated with screen. graphics-port is never visible on the screen, but can be used to query fonts, measure text and load images to obtain their width and height. Drawing functions are not supported.

See also convert-to-screen

current-dialog-handle

Function

Summary
Returns the underlying handle of the current dialog.

Package
capi

Signature
current-dialog-handle => handle

Values
handle A platform-specific value, or nil.

Description
The function current-dialog-handle returns the underlying handle of the current dialog, as follows:

Microsoft Windows
The hwnd of the dialog.

GTK+ A pointer to the GdkWindow.

Motif A windowid of the dialog.

Cocoa The value returned by the NSWindow's windowNumber method.

This value is useful if you want to perform some operation on the underlying handle that the CAPI does not supply.

If there is no current dialog, current-dialog-handle returns nil.

Example
Press on "Get handle" to see the handle of the dialog.
(capi:popup-confirm)
(make-instance
 'capi:push-button
 :text "Get handle"
 :callback-type :none
 :selection-callback
 #'(lambda ()
     (capi:display-message
      (format nil "current-dialog-handle-~a~%
                   (capi:current-dialog-handle)))
     nil
     :title "A dialog"
)

See also simple-pane-handle
"Handles" on page 265

current-document

Generic Function

Summary Returns the current document of a MDI interface.

Package capi

Signature current-document mdi-interface => child

Arguments mdi-interface An instance of a subclass of document-frame.

Values child The current document of mdi-interface.

Description The generic function current-document returns the top
child interface of a MDI interface.

See also document-frame

current-pointer-position

Function

Summary Returns the current position of the pointer.
Package  

Signature  
current-pointer-position &key relative-to pane-relative-p => x, y

Arguments  
relative-to A screen or a displayed interface or a CAPI pane.
pane-relative-p A boolean.

Results  
x An integer.
y An integer.

Description  
The function current-pointer-position returns the current x,y position of the pointer on the screen of relative-to, which defaults to the current screen.

If pane-relative-p is true then the position is returned relative to relative-to, otherwise it is returned relative to the screen. The default value of pane-relative-p is t.

See also interface screen

current-popup

Function

Summary  
Returns the current popup pane if there is one.

Signature  
current-popup => result

Values  
result A pane or nil.

Description  
The function current-popup returns the current popup pane or nil if there is none. A current popup exists in the scope of callbacks which are done while a dialog is displayed on the screen in the current process.
If the dialog was raised by an explicit call to `display-dialog` or `popup-confirm`, `current-popup` returns the first argument of `display-dialog` or `popup-confirm`. For other functions that raise a dialog (such as the `prompt-for-file`, `prompt-for-confirmation` and so on), the result is CAPI pane created by the system.

See also
- `display-dialog`
- `popup-confirm`

**current-printer**

*Function*

**Summary**

Returns the currently selected printer object.

**Package**

capi

**Signature**

current-printer &key interactive => printer

**Arguments**

interactive A boolean.

**Values**

printer A printer, or nil.

**Description**

The function `current-printer` returns the currently selected printer object for the default library.

If `interactive` is non-nil and there is no current printer, a confirmer is displayed warning the user and `printer` is nil. The default value of `interactive` is nil.

See also
- `page-setup-dialog`
- `set-printer-options`

“Printing from the CAPI—the Hardcopy API” on page 249
*default-editor-pane-line-wrap-marker* Variable

Summary  The default line wrap marker for editor panes.

Package  capi

Initial Value  #\!

Description  The variable *default-editor-pane-line-wrap-marker* provides the default value for the line-wrap-marker of an editor-pane. The value should be a character object, or nil.

See also  editor-pane

*default-non-focus-message-timeout*  *default-non-focus-message-timeout-extension* Variables

Summary  Specify the default timeout and timeout-extension in display-non-focus-message.

Package  capi

Initial value  The initial value of *default-non-focus-message-timeout* is 2

The initial value of *default-non-focus-message-timeout-extension* is 60.

Description  The variables *default-non-focus-message-timeout* and *default-non-focus-message-timeout-extension* specify the default timeout and timeout-extension in display-non-focus-message respectively.

See display-non-focus-message for details.

See also  display-non-focus-message
**default-library**

*Function*

**Summary** Returns the default library.

**Package** capi

**Signature** default-library => library

**Values** library A library name.

**Description**

The function `default-library` returns a keyword naming the default library.

On Linux, FreeBSD, AIX and x86/x64 Solaris platforms, the default library is :gtk. If you load the deprecated “capi-motif” module, then the library will be :motif.

On Microsoft Windows platforms, currently the only library available is :win32, hence this is the default library.

On Mac OS X platforms, the only library available in the native GUI image is :cocoa, hence this is the default library. In the Mac OS X/GTK+ image, the default library is :gtk, but you load the deprecated "capi-motif" module, then the library will be :motif.

In LispWorks for SPARC Solaris, currently the only library available is :motif, hence this is the default library.

**See also**

installed-libraries

“CAPI communication with host window system - libraries” on page 272

**define-command**

*Macro*

**Summary** Defines an alias for a mouse or keyboard gesture that can be used in the input model of an output pane.
Package  capi

Signature  \texttt{define-command} \texttt{name}\texttt{ gesture} \texttt{&key} \texttt{translator} \texttt{host} \texttt{library}

Arguments

\begin{itemize}
  \item \textit{name}  A unique Lisp object.
  \item \textit{gesture}  A valid input model gesture.
  \item \textit{translator}  A function.
  \item \textit{host}  Alias for library, for backwards compatibility.
  \item \textit{library}  Specifies for which library this mapping is applicable. See \textless new section above about libraries\textgreater{} for which libraries are applicable. By default the mapping is applicable to all libraries.
\end{itemize}

Description  The macro \texttt{define-command} defines an alias for an input gesture that can then be used in \texttt{output-pane}'s input models.

\textit{name} is the name of the alias, which should be a symbol.

\textit{gesture} is one of the gestures accepted by \texttt{output-pane}. For a full description of the gesture syntax and arguments for the callback, see “Detailed description of the input model” on page 179. It is possible to specify multiple gestures by passing as \textit{gesture} a list of the form

\begin{verbatim}
(:one-off gesture1 gesture2 ...)
\end{verbatim}

If \textit{translator} is supplied it needs to be a function that takes the same arguments that a callback for the gesture would take (not including the \texttt{extra-callback-args}), and returns a list which is used after \textit{pane} instead of the gesture callback arguments. When there is a \textit{translator}, the callbacks for commands in the models are invoked by:

\begin{verbatim}
(apply callback pane \\
  (append (apply translator gesture-callback-args) \\
          extra-callback-args))
\end{verbatim}
library specifies which library this mapping is applicable to. It is possible to have distinct definitions for different libraries, but redefinition with the same library overrides the previous definition. The default value of library is nil, which means all libraries.

Example

Firstly, here is an example of defining a command which maps onto a gesture.

```lisp
(defun gesture-callback (output-pane x y)
  (capi:display-message
   "Pressed ~S at (~S,~S)"
   output-pane x y))

(capi:define-command :select (:button-1 :press))

(capi:contain (make-instance
    'capi:output-pane
    :input-model '((:select
gesture-callback))))
```

Here is a more complicated example demonstrating the use of translator to affect the arguments passed to a callback.

```lisp
(capi:define-command
:select-object (:button-1 :press)
:translator #'(lambda (output-pane x y)
  (let ((object
      (capi:pinboard-object-at-position
        output-pane x y)))
    (when object
      (list object)))))

(defun object-select-callback (output-pane &optional object)
  (when object (capi:display-message
    "Pressed on ~S in ~S"
    object output-pane)))

(setq pinboard
  (capi:contain (make-instance
    'capi:pinboard-layout
    :input-model '((:select-object
        object-select-callback))))))
```
Here is a further example:

(example-edit-file "capi/output-panes/commands")

See also

output-pane
invoke-command
invoke-untranslated-command
“Commands - aliases” on page 186

define-interface

Macro

Summary

Defines subclasses of interface.

Package
capi

Signature

define-interface name superclasses slots &rest options

Description

The macro define-interface is used to define subclasses of interface, which when created with make-instance has the specified panes, layouts and menus created automatically. The slots and superclasses are used to describe the slots and superclasses of name as in the defclass macro, except that if superclasses is non-nil it must include interface or a subclass of it.

define-interface accepts the same options as defclass, plus the following extra options:

:panes Descriptions of the interface’s panes.

:layouts Descriptions of the interface’s layouts.
:menus  Descriptions of the interface’s menus.
:menu-bar  A list of menus for the interface’s menu bar.
:definition  Options to alter define-interface.

The class options :panes, :layouts and :menus add extra slots to the class that will contain the CAPI object described in their description. Within the scope of the extra options, the slots themselves are available by referencing the name of the slot, and the interface itself is available with the variable capi:interface. Each of the slots can be made to have readers, writers, accessors or documentation by passing the appropriate defclass keyword as one of the optional arguments in the description. Therefore, if you need to find a pane within an interface instance, you can provide an accessor, or simply use with-slots.

The option :panes is a list of pane descriptions of the following form

( :panes
  (slot-name pane-class initargs)
  ...
  (slot-name pane-class initargs)
)

where slot-name is a name for the slot, pane-class is the class of the pane being included in the interface, and initargs are the initialization arguments for the pane - the allowed forms are described below.

The option :layouts is a list of layout descriptions of the following form

( :layouts
  (slot-name layout-class children initargs)
  ...
  (slot-name layout-class children initargs)
)

where slot-name is a name for the slot, layout-class specifies the type of layout, children is a list of children for the layout, and initargs are the initialization arguments for the layout -
the allowed forms are described below. The primary layout for the interface defaults to the first layout described, but can be specified as the :layout initarg to the interface. If no layouts are specified, then the CAPI will place all of the defined panes into a column layout and make that the primary layout.

The option :menus is a list of menu and menu component descriptions of the following form

```lisp
(:menus
   (slot-name title descriptions initargs)
   ...
   (slot-name title descriptions initargs))
```

*slot-name* is the slot name for each menu or menu component.

*title* is the menu’s title, the keyword :menu, or the keyword :component. For an example showing how you can specify mnemonics for menu titles, see “Mnemonics in menus” on page 117.

*descriptions* is a list of menu item descriptions. Each menu item description is either a title, a slot name for a menu, or a list of items containing a title, descriptions, and a list of initialization arguments for the menu item. *descriptions* should nil if you specify the :items-function initarg.

*initargs* are the initialization arguments for the menu.

The values given in *initargs* under :panes, :layouts and :menus can be lists of the form

```lisp
(:initarg keyword-name)
(:initarg key-spec)
(:initarg key-spec initarg-value)
```

*key-spec* := var | (var) | (var initform) | ((keyword-name var)) | ((keyword-name var) initform)

*keyword-name* := any keyword
key-spec is interpreted as in the \&key symbol of ordinary Common Lisp lambda lists. When this form of value is used, the specified keyword-name is added as an extra initarg to the class defined by the define-interface form.

If key-spec is followed by initarg-value, then its value is used as the initarg of the pane. Otherwise the value from key-spec is used.

Additionally initargs may contain the keyword argument :make-instance-extra-apply-args which is useful when you want to supply initargs to the pane slot-name when the interface is initialized. The value make-instance-extra-apply-args should be a keyword which becomes an extra initarg to the interface class name. The value of that initarg should be a list of pane initargs and values which is passed when the pane is initialized. For an example, see:

(example-edit-file "capi/applications/argument-passing")

The option :menu-bar is a list of slot names, where each slot referred to contains a menu that should appear on the menu bar.

The option :definition is a property list of arguments which define-interface uses to change the way that it behaves. Currently there is only one definition option:

:interface-variable

Allows you to specify the name of a variable which (lexically within the define-interface form) refers to the interface instance. By default this variable is capi:interface. See the example below.

Example Firstly, a couple of pane examples:
(capi:define-interface test1 ()
 ()
 (:panes
  (text capi:text-input-pane))
 (:default-initargs :title "Test1"))

(capi:display (make-instance 'test1))

(capi:define-interface test2 ()
 ()
 (:panes
  (text capi:text-input-pane)
  (buttons capi:button-panel :items '(1 2 3)
     :reader test2-buttons))
 (:layouts
  (main-layout capi:column-layout '(text buttons)))
 (:default-initargs :title "Test2"))

(test2-buttons
 (capi:display (make-instance 'test2)))

Here are a couple of menu examples:

(capi:define-interface test3 ()
 ()
 (:menus
  (color-menu "Colors" (:red :green :blue)
     :print-function 'string-capitalize)
 (:menu-bar color-menu)
 (:default-initargs :title "Test3"))

(capi:display (make-instance 'test3))
(capi:define-interface test4 ()
() (:menus (colors-menu "Colors"
  ((:component (:red :green :blue)
    :interaction :single-selection
    :print-function 'string-capitalize)
    more-colors-menu))
  (more-colors-menu "More Colors"
    (:pink :yellow :cyan)
    :print-function 'string-capitalize))
  (:menu-bar colors-menu)
  (:default-initargs :title "Test4"))
(capi:display (make-instance 'test4))

This example demonstrates inheritance amongst subclasses of interface:

(capi:define-interface test5 (test4 test1) ()
  (:default-initargs :title "Test5"))
(capi:display (make-instance 'test5))

The next three examples illustrate the use of :initarg in initarg specifications for :panes.

Here we initialize the :selected-items initarg of the pane foo to the value passed by :select when making the interface object, or nil otherwise:
Here we initialize the `:selected-items` initarg of pane `foo` to the value passed by `:select` initarg when making the interface object, or `(1 3)` otherwise:

```lisp
(capi:define-interface init1 () ()
  (:panes
   (foo
    capi:list-panel
    :items '(0 1 2 3 4)
    :visible-min-height '(:character 5)
    :interaction :multiple-selection
    :selected-items (:initarg select))))

(capi:contain (make-instance 'init1
   :select '(1 3)))

(capi:contain (make-instance 'init1))
```

Here we increment the indices passed in the interface’s `:select` initarg before passing them in the `:selected-items` initarg of pane `foo`:

```lisp
(capi:define-interface init2 () ()
  (:panes
   (foo
    capi:list-panel
    :items '(0 1 2 3 4)
    :visible-min-height '(:character 5)
    :interaction :multiple-selection
    :selected-items
    (:initarg (select '(1 3)))))

(capi:contain (make-instance 'init2))
```

Here we increment the indices passed in the interface’s `:select` initarg before passing them in the `:selected-items` initarg of pane `foo`:

```lisp
(capi:define-interface init3 () ()
  (:panes
   (foo
    capi:list-panel
    :items '(0 1 2 3 4)
    :visible-min-height '(:character 5)
    :interaction :multiple-selection
    :selected-items
    (:initarg select
     (mapcar '1+ select)))))

(capi:contain (make-instance 'init3
   :select '(1 3)))
```
This example illustrates the use of :interface-variable. Both menu commands act on the interface itself, but they receive this argument in different ways:

```
(capi:define-interface foo () ()
 (:menus
  (menu "Run"
   ("Interface Variable"
    :callback (lambda () (test xxx))
    :callback-type :none)
   (":callback-type :interface"
    :callback 'test
    :callback-type :interface)))
 (:menu-bar menu)
 (:definition :interface-variable xxx))

(defmethod test ((foo foo))
  (capi:display-message "foo"))

(capi:display (make-instance 'foo))
```

There are many more examples in the LispWorks installation directory under examples/capi/.

See also
- interface
- layout
- menu

Chapter 8, “Creating Menus”
Chapter 10, “Defining Interface Classes - top level windows”

---

**define-layout**

*Macro*

**Summary**

Defines new classes of layout.

**Package**

capi

**Signature**

define-layout name superclasses slots &rest options
Description

The macro `define-layout` is used to create new classes of `layout`. The macro is essentially the same as `defclass` except that its default superclass is `layout`.

To implement a new class of `layout`, methods need to be provided for the following generic functions:

- `interpret-description`
  - Translate the layout's child descriptions.

- `calculate-constraints`
  - Calculate the constraints for the layout.

- `calculate-layout`
  - Layout the children of the layout.

See also

- `interpret-description`
- `calculate-constraints`
- `calculate-layout`
- `layout`

---

**define-menu**

*Macro*

**Summary**

Defines a menu function.

**Package**

`capi`

**Signature**

```
define-menu function-name (self) title menu-body &rest menu-options
```

**Description**

The macro `define-menu` defines a function called `function-name` with a single argument `self` that will make a menu. The parameters `title`, `menu-body` and `menu-options` take the same form as the `:menus` section of `define-interface`. 
Example

(capi:define-menu make-test-menu (self)
  "Test"
  (*Item1*
   *Item2*
   (:component
     (*Item3*
      "Item4")
     :interaction :single-selection)
  (:menu
   (*Item5*
    "Item6")
   :title "More Items")))

(setq interface (make-instance 'capi:interface))

(setf (capi:interface-menu-bar-items interface)
  (list (make-test-menu interface)))

(capi:display interface)

See also

define-interface
menu
undefine-menu

define-ole-control-component

Macro

Summary

Defines a class that implements the OLE Control protocol for a CAPI pane.

Package

capi

Signature

define-ole-control-component class-name (superclass-name*)
slots &rest class-options

Description

The macro define-ole-control-component defines an Automation component class class-name (like com:define-automation-component) that also implements the OLE Control protocols and other named interfaces or a coclass. This allows a CAPI pane to be embedded in an OLE Control container implemented outside LispWorks.
Each superclass-name argument specifies a direct superclass of
the new class, which can be any standard-class provided
that certain standard classes are included somewhere in the
overall class precedence list. These standard classes depend
on the other options and provide the default superclass list if
none is specified. The following standard classes are avail-
able:

ole-control-component is always needed and provides an
implementation of the OLE Control protocol.

com:standard-i-dispatch is always needed and provides
a complete implementation of the i-dispatch interface, based
on the type information in a type library.

com:standard-i-connection-point-container is needed
if there are any source interfaces specified (via the :coclass
or :source-interfaces options). This provides a complete
implementation of the Connection Point protocols, used to
support events.

slots is a list of standard defclass slot definitions.

class-options are standard defclass options. In addition the
following options are recognized:

(:variablecoclass coclass-name)

(:interfaces interface-name*)

(:source-interfaces interface-name*)

See com:define-automation-component in the LispWorks
of these options.

Typically the :pane-function and :create-callback ini-
targs are supplied using the :default-initarg option.

Implementations of the methods in the :coclass and
:interfaces options should be defined using com:define-
com-method, com:define-dispinterface-method or
com:com-object-dispinterface-invoke.
Notes  

define-ole-control-component is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")).

Example  

(example-edit-file "com/ole/control-implementation/deliver.lisp")

See also  

ole-control-component

destroy  

Generic Function

Summary  
Closes a window and calls the destroy-callback.

Package  
capi

Signature  
destroy  interface

Description  
The generic function destroy closes the window associated with interface, and then calls the interface’s destroy-callback if it has one.

There is a complementary function quit-interface which calls the interface’s confirm-destroy-function to confirm that the destroy should be done, and it is advisable to always use this unless you want to make sure that the interface’s confirm-destroy-function is ignored.

Notes  

destroy must only be called in the process of interface. Menu callbacks on interface will be called in that process, but otherwise you probably need to use execute-with-interface or apply-in-pane-process.
Example

```lisp
(setq interface
      (capi:display (make-instance
                     'capi:interface
                     :title "Test Interface"
                     :destroy-callback
                     #'(lambda (interface)
                         (capi:display-message
                          "Quitting ~S" interface))))

      (capi:apply-in-pane-process
       interface 'capi:destroy interface))

See also

interface
quit-interface
*update-screen-interfaces-hooks*
Chapter 7, "Programming with CAPI Windows"

destroy-dependent-object

Generic Function

Summary
A mechanism to destroy objects when a pinboard-layout is destroyed.

Package
capi

Signature
destroy-dependent-object object

Method signatures
destroy-dependent-object pinboard-layout (object cl:cons)
destroy-dependent-object pinboard-layout (object mp:process)

Arguments

pinboard-layout A pinboard-layout.
object A Lisp object.

Description
The generic function destroy-dependent-object is part of a mechanism for destroying objects when a pinboard-layout is destroyed.
Objects may be registered for destruction by calling `record-dependent-object` and unregistered by calling `unrecord-dependent-object`.

The predefined `destroy-dependent-object` method specializing on `cl:cons` expects a list where the car is a function and the cdr are its arguments. It applies the function to the arguments. The predefined method specializing on `mp:process` calls `mp:process-terminate` on the process object.

See also
- `pinboard-layout`
- `record-dependent-object`
- `unrecord-dependent-object`

### detach-simple-sink

**Summary**
Detaches a previously-attached simple sink object.

**Package**
capi

**Signature**
detach-simple-sink sink pane

**Arguments**
sink A class instance.
pane An ole-control-pane.

**Description**
The function `detach-simple-sink` detaches a sink that was previously attached to the active component in the ole-control-pane pane by a call to `attach-simple-sink`.

`sink` is the value returned by `attach-simple-sink` when the sink was attached.

`pane` is an ole-control-pane which is the pane where the component is.

Attached sinks are automatically disconnected when the object is closed.
Notes: This function is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")).

See also:
- `attach-simple-sink`
- `ole-control-pane`

### detach-sink

**Function**

**Summary**
Detaches a previously-attached sink.

**Package**
capi

**Signature**
detach-sink sink pane interface-name

**Arguments**
- `sink`: A class instance.
- `pane`: An `ole-control-pane`.
- `interface-name`: A refguid or the symbol `:default`.

**Description**
The function `detach-sink` detaches a sink which was previously attached to the active component in the `ole-control-pane` pane.

- `sink` is an instance of a class that implements the interface `interface-name`.
- `pane` is an `ole-control-pane` which is the pane where the component is.
- `interface-name` is either a string naming a source interface that the component in `pane` supports or `:default` to disconnect from the default source interface.

Attached sinks are automatically disconnected when the object is closed.

**Notes**
This function is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`. 

401
display

Function

Summary
Displays a CAPI interface on a specified screen.

Package
capi

Signature
display interface &key screen owner window-styles process =>
interface

Arguments

interface A CAPI interface.

screen A screen, or any argument accepted by convert-to-screen.

owner A CAPI interface.

window-styles A list of keywords.

process On GTK+, Microsoft Windows or Motif, a CAPI process, t or nil. On Cocoa, this argument is not supported.

Values
interface A CAPI interface.

Description
The function display displays the CAPI interface interface on the specified screen (or the current one if not supplied).

If process is not supplied, then if owner is supplied interface runs in owner’s process, otherwise interface runs in the process of the parent of interface if it is a document-container, or in a new process created for interface if not.

On Microsoft Windows and Motif, if process is t, then interface runs in a newly-created process. If process is nil, interface runs in the current process. Otherwise process is expected to be a CAPI process, and interface runs in it. A CAPI process is
a `mp:process` which was created by calling `display`. You can pass only a CAPI process as `process`, because it needs to handle messages using the LispWorks event loop. The default value of `process` is `t`.

On Cocoa, all CAPI interfaces run in the Cocoa Event Loop process (which is the main thread of LispWorks) and therefore the `process` argument is not supported. If the value of `process` is any process other than the Cocoa Event Loop process an error is signalled.

`owner` specifies an owner for `interface`, which should be another CAPI interface. `interface` inherits a number of attributes from `owner`, including the default process, default screen and default display state.

`window-styles`, if supplied, sets the `window-styles` slot of `interface`. See `interface` for information about `window-styles`.

`display` returns its `interface` argument.

Notes
1. Use the function `contain` to display objects other than interfaces.
2. Once `display` has finished preparing the interface to display, it calls `interface-display` to actually do the display. The primary method does the actual display, and you can `:before` or `:after` methods to execute code just before or just after the window appears.

Example

```lisp
(capi:display (make-instance 'capi:interface
  :title "Test"))
```

See also

- `contain`
- `convert-to-screen`
- `display-dialog`
- `document-container`
- `execute-with-interface`
- `interface`
- `interface-display`
quit-interface
*update-screen-interfaces-hooks*
Chapter 2, “Getting Started”
“The correct thread for CAPI operations” on page 39
Chapter 19, “Host Window System-specific issues”
Chapter 7, “Programming with CAPI Windows”
“Dialog Owners” on page 162

display-dialog

Function

Summary Displays a CAPI interface as a dialog box.

Package capi

Signature display-dialog interface &key screen focus modal owner x y position-relative-to continuation callback-error-handler => result, okp

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>interface</td>
<td>A CAPI interface.</td>
</tr>
<tr>
<td>screen</td>
<td>A screen.</td>
</tr>
<tr>
<td>focus</td>
<td>A pane of interface.</td>
</tr>
<tr>
<td>modal</td>
<td>t, :dismiss-on-input or nil.</td>
</tr>
<tr>
<td>owner</td>
<td>A pane.</td>
</tr>
<tr>
<td>x, y</td>
<td>Real numbers representing coordinates, or keywords or lists specifying an adjusted position.</td>
</tr>
<tr>
<td>position-relative-to</td>
<td>:owner or nil.</td>
</tr>
<tr>
<td>continuation</td>
<td>A function or nil.</td>
</tr>
<tr>
<td>callback-error-handler</td>
<td>A function designator or nil.</td>
</tr>
</tbody>
</table>
Values

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>result</td>
<td>An object.</td>
</tr>
<tr>
<td>okp</td>
<td>A boolean.</td>
</tr>
</tbody>
</table>

Description

The function `display-dialog` displays the CAPI interface as a dialog box.

`screen` is the `screen` for the dialog to be displayed on.

`focus` should be the pane within the interface that should be given the focus initially. If a focus is not supplied, then it lets the window system decide.

A true value of `modal` indicates that the dialog takes over all input to the application. Additionally, if `modal` is `:dismiss-on-input` then any user gesture (a button or key press) causes the dialog to disappear. `:dismiss-on-input` works on platforms other than Motif. The default value of `modal` is `t`.

`owner` specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If `x` and `y` are numbers they specify the coordinates of the dialog. Alternatively `x` and `y` can be keywords like `:left` and `:top`, or lists like `(:left 100), (:bottom 50)` and so on.. These values cause the dialog to be positioned relative to its owner in the same way as the `adjust` argument to `pane-adjusted-position`. The default location is at the center of the dialog’s owner.

`position-relative-to` has a default value `:owner`, meaning that `x` and `y` are relative to dialog’s owner. The value `nil` means that `x` and `y` are relative to the screen.

If `continuation` is non-nil, then it must be a function with a lambda list that accepts two arguments. The `continuation` function is called with the values that would normally be returned by `display-dialog`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `display-dialog` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.
The values returned depend on how the dialog is dismissed. Typically a user gesture will trigger a call to \texttt{abort-dialog}, causing the values \texttt{nil, nil} to be returned or to \texttt{exit-dialog} causing the values \texttt{result, t} to be returned, where \texttt{result} is the argument to \texttt{exit-dialog}. If \texttt{continuation} is non-nil, then the returned values are always \texttt{:continuation, nil}.

The CAPI also provides \texttt{popup-confirmer} which gives you the standard \texttt{OK} and \texttt{Cancel} button functionality.

\texttt{callback-error-handler} allows error handling in callbacks which is uniform across platforms, as described for \texttt{popup-confirmer}.

**Notes**

1. If you need to replace one dialog with another, you can use \texttt{display-replacable-dialog} and \texttt{replace-dialog}.

2. In a modal dialog at least one button which aborts or exits the dialog must be provided in \texttt{interface}. This is the programmer's responsibility, as without such a button there is no way to clear the modal dialog. A straightforward way to add these buttons is to display the window via \texttt{popup-confirmer} which adds the buttons for you.

**Example**

\begin{verbatim}
(capi:display-dialog
 (capi:make-container
  (make-instance 'capi:push-button-panel
   :items '("OK" "Cancel")
   :callback-type :data
   :callbacks '(capi:exit-dialog
capi:abort-dialog))
   :title "Empty Dialog"))
\end{verbatim}

There are further examples:

\begin{verbatim}
(example-edit-file "capi/dialogs/"
\end{verbatim}

**See also**

\begin{verbatim}
abort-dialog
display
display-replacable-dialog
\end{verbatim}
exit-dialog
interface
popup-确认器
with-dialog-results
*update-screen-interfaces-hooks*
Chapter 11, "Dialogs: Prompting for Input"

display-errors

**Macro**

Summary Displays a message if an error is signalled.

Package capi

Signature `display-errors &body body`

Description The macro `display-errors` executes the code of `body` inside a `handler-case` form. If an error is signalled inside `body`, a message is displayed and the debugger is not entered.

display-message

**Function**

Summary The function `display-message` displays a message on the current CAPI screen.

Package capi

Signature `display-message format-string &rest format-args`

Description The function `display-message` creates a message from the arguments using `format`, and then displays it on the current CAPI screen.

Notes If you need to make a window-modal sheet on Cocoa, then use the function `prompt-with-message`.
Example

(capi:display-message "Current screen = -S"
  (capi:convert-to-screen))

See also

prompt-with-message
display-message-for-pane
display-non-focus-message
display-dialog
Chapter 2, “Getting Started”
Chapter 11, “Dialogs: Prompting for Input”

display-message-for-pane

Function

Summary
Displays a message on the same screen as a specified pane.

Package
capi

Signature
display-message-for-pane pane format-string &rest format-args

Description
The function display-message-for-pane creates a message from the arguments format-string and format-args using format, and then displays it on the same screen as pane.

Notes
If you need to make a window-modal sheet on Cocoa, then use the function prompt-with-message.

Compatibility note
The function display-message-on-screen is retained for compatibility with previous versions of LispWorks. It is a synonym for display-message-for-pane.

Example

(setq pane (capi:contain (make-instance 'capi:text-input-pane)))

(capi:display-message-for-pane pane
  "Just created -S" pane)

See also

prompt-with-message
display-message
**display-non-focus-message**

**Function**

**Summary**
Display a message in a non-focus window for a short period of time.

**Package**
capi

**Signature**
display-non-focus-message string &key timeout timeout-extension owner x y alternative-right alternative-bottom alternative-x alternative-y bottom right transparency background font widget-name

**Arguments**
- **string** A string or a list of strings.
- **timeout** A positive integer.
- **timeout-extension** A positive integer.
- **owner** A visible CAPI pane
  - *x*, **alternative-x**, **right**
    - An integer, or one of the keywords :left, :right, :center and :centre.
  - **alternative-right** An integer, or one of the keywords :left, :right, :center and :centre, or t.
  - *y*, **alternative-y**, **bottom**
    - An integer, or one of the keywords :top, :bottom, :center and :centre.
  - **alternative-bottom** An integer, or one of the keywords :top, :bottom, :center and :centre, or t.
  - **transparency** A real number in the inclusive range [0,1].
  - **background** A color in the Graphics Ports color system.
  - **font** A font or a font-description, or a positive integer.
  - **widget-name** A string designator.
Description

The function `display-non-focus-message` displays a message in a non-focus window for a short period of time, to notify the user of something that does not actually require their attention.

`string` is the message. It should be either a string, or a list of strings, which are concatenated with newlines to give the actual text to display. `#
Newline` characters in `string` break lines as expected.

`timeout`, if supplied, should be a positive integer. It specifies the time in seconds before the window displaying the message disappears. The default value of `timeout` is `*default-non-focus-message-timeout*`.

`timeout-extension` is used when the user tries to copy the message text. The default value of `timeout-extension` is `*default-non-focus-message-timeout-extension*`. See “Copying from the message” below for discussion.

`owner` should be a visible CAPI pane. The positioning of the non-focus window is with respect to `owner`.

`x`, `y`, `right`, `bottom`, `alternative-x`, `alternative-y`, `alternative-right`, and `alternative-bottom` are used for positioning the window. `x`, `alternative-right`, `alternative-x` and `right` are the horizontal keywords, and one of them determines the horizontal position as described below. `y`, `alternative-bottom`, `alternative-y` and `bottom` are the vertical keywords, and one of them determines the vertical position. The values `:center` and `:centre` are synonyms here.

`x` and `y` specify the positioning of the left and top sides of the window, except for `:center`/`:centre`. An integer means offset in pixels from the left or top of `owner`. `:left`, `:right`, `:top` and `:bottom` mean the left/right/top/bottom of `owner`. `:center` means the center of the owner, and in this case it specifies the location of the center of the window in the `x` or `y` dimension. The default value of both `x` and `y` is `:center`. 
right and bottom override x and y respectively. They specify the positioning of the right or bottom of the window, except for :center / :centre, where they are interpreted in the same way as x and y.

alternative-x, alternative-y, alternative-right, and alternative-bottom are used if positioning the window using x or right and y or bottom would place it outside of the screen, and are interpreted the same way as the non-alternative keywords. The decision to use the alternative variables is made independently in the horizontal and vertical directions. alternative-right and alternative-bottom can both take the special value t, meaning the screen width and height.

transparency specifies the transparency of the window. See interface for details.

background specifies the background color of the window.

font specifies the font to use. If it is a positive integer it specifies the font size, that is equivalent to:

(gp:make-font-description :size font)

widget-name specifies the widget-name of the interface that displays the window. See element for details.

Copying from the message
The user can select part of the message with the mouse, and then copy it using the context menu (raised by right-click). Whenever the user changes the selection or cursor position, the timeout is re-scheduled with timeout-extension seconds, so the window does not disappear while the user tries to copy.

The context menu also has a Close item, so the user can explicitly close the window once she has finished.

Notes
Because display-non-focus-message raises a window that does not take the focus, it does not interfere with what the user is already doing (except when the user clicks on the window). It is therefore useful to notify the user about events
that do not actually require the user to stop what they are doing and do something, for example when a saving operation is complete.

See also display-message
*default-non-focus-message-timeout*
*default-non-focus-message-timeout-extension*

display-pane

Summary The class display-pane is a pane that displays multiple lines of text.

Package capi

Superclasses titled-object
  simple-pane

Initargs :text A string or a list of strings to be displayed.

Accessors display-pane-text

Description The text passed to a display pane can be provided either as a single string containing newlines, or else as a list of strings where each string represents a line.
Example

{(capi:contain (make-instance 'capi:display-pane :text '("One" "Line" "At" "A" "Time...")) )

(setq dp (capi:contain (make-instance 'capi:display-pane :text '("One" "Line" "At" "A" "Time...") :visible-min-height '(:character 5))))

(capi:apply-in-pane-process dp #'(setf capi:display-pane-text) '("Some" "New" "Text") dp)

See also
display-pane-selected-text
display-pane-selection
display-pane-selection-p
editor-pane
set-display-pane-selection
text-input-pane
title-pane
"Displaying and entering text" on page 20

display-pane-selected-text

Function

Summary
Returns the selected text in a display-pane.

Package
capi

Signature
display-pane-selected-text display-pane => result

Arguments
display-pane An instance of display-pane or a subclass.

Values
result A string or nil.
Description

The function `display-pane-selected-text` returns the selected text in `display-pane`, or `nil` if there is no selection.

See also

display-pane
display-pane-selection-p
display-pane-selection

**display-pane-selection**

*Function*

**Summary**

Returns the bounds of the selection in a `display-pane`.

**Package**

capi

**Signature**

`display-pane-selection pane => start, end`

**Arguments**

`pane` A `display-pane`.

**Values**

`start, end` Non-negative integers.

**Description**

The function `display-pane-selection` returns as multiple values the bounding indexes of the selection in `pane`. That is, `start` is the inclusive index of the first selected character, and `end` is one greater than the index of the last selected character.

If there is no selection, then both `start` and `end` are the caret position in `pane`.

See also

`set-display-pane-selection`
display-pane
display-pane-selected-text
display-pane-selection-p

**display-pane-selection-p**

*Function*

**Summary**

Returns true if there is selected text in a `display-pane`. 
**display-pane-selection-p**

**Signature**

display-pane-selection-p pane => selectionp

**Arguments**

- pane: A display-pane.

**Values**

- selectionp: A boolean.

**Description**

The function display-pane-selection-p returns t if there is a selected region in pane and nil otherwise.

**See also**

set-display-pane-selection
display-pane
display-pane-selected-text
display-pane-selection

---

**display-popup-menu**

**Function**

**Summary**

Displays a popup menu.

**Package**

capi

**Signature**

display-popup-menu menu &key owner x y button => result

**Arguments**

- menu: A menu.
- owner: A pane.
- x: The horizontal coordinate of menu’s position relative to owner.
- y: The vertical coordinate of menu’s position relative to owner.
- button: The mouse button that raises the menu.
The function `display-popup-menu` displays the menu at position `x,y`. `display-popup-menu` should be used in response to the user clicking a mouse button, and is typically used to implement context ("right button") menus.

The user may select an item in the menu, in which case the item's `selection-callback` is invoked, and `display-popup-menu` returns `t`.

Alternatively the user may cancel the menu, by clicking elsewhere or pressing the `Escape` key. In this case, `display-popup-menu` returns `nil`.

`owner` specifies the owner of the menu, that is, a pane that the menu is associated with. If `owner` is not supplied the system tries to find the appropriate owner, which usually suffices.

`x` and `y` default to the horizontal and vertical coordinates, relative to `owner`, of the location of the mouse pointer.

`button` defaults to `:button-3`.

See “Displaying menus programmatically” on page 123.

See also
- `menu`
- `pinboard-layout`
- `popup-menu-force-popdown`
- “Displaying menus programmatically” on page 123

---

display-replacable-dialog

Function

Displays a replacable dialog.

 Package  capi

 Signature  `display-replacable-dialog interface &rest args => result`

 Arguments  `interface`  An interface.
The function `display-replacable-dialog` displays a dialog that can be replaced by another dialog. `display-replacable-dialog` displays the dialog like `display-dialog`.

Within the scope of `display-replacable-dialog` (that is, inside the callbacks) the programmer can call `replace-dialog` which replaces the dialog by a new dialog and destroys the existing one. There can be many calls to `replace-dialog` inside the same scope of `display-replacable-dialog`.

`display-replacable-dialog` returns the last dialog that was displayed.

Inside `display-replacable-dialog`, the functions that use the current dialog, such as `exit-dialog` and `abort-dialog`, work in the same way that they work inside `display-dialog`, except that they don’t affect the return value of `display-replacable-dialog`.

See also

- `abort-dialog`
- `display-dialog`
- `exit-dialog`
- `replace-dialog`

---

### display-tooltip

**Generic Function**

**Summary**

Displays tooltip help on an output pane.
Package            capi

Signature           display-tooltip output-pane &key x y text => result

Arguments           output-pane  An instance of a subclass of output-pane.
x           The horizontal coordinate of the tooltip position.
y           The vertical coordinate of the tooltip position.
text           The help text.

Description         The generic function display-tooltip displays text as tooltip help at position x,y in output-pane.

Notes               1. On GTK+ display-tooltip is implemented only for GTK+ versions 2.12 and later
2. On GTK+ the :x and :y arguments might not be handled.

Compatibility note  On GTK+ display-tooltip is not implemented in LispWorks 6.0.

Example             (example-edit-file "capi/graphics/pinboard-help")

See also            “Toolips for output panes” on page 35

docking-layout      Class

Summary              A class that implements docking of panes.

Package              capi

Superclasses         simple-layout
Initargs

:items  A list of pane specifications. The panes become the items in the layout.

:controller  A controller for the layout, which can make multiple docking-layouts work together.

:docking-test-function  A function controlling whether a pane can be docked in a docking-layout.

:docking-callback  A function called when a pane is docked or undocked.

:divider-p  A boolean allowing a visible edge around the layout.

:orientation  One of :horizontal or :vertical.

Accessors

docking-layout-controller
docking-layout-divider-p
docking-layout-docking-test-function
docking-layout-items

Readers

docking-layout-orientation

Description  

The class docking-layout defines a region in which panes can be docked and undocked. The undocking functionality works only in LispWorks for Windows.

If controller is non-nil, it must be a controller object as returned by a call to make-docking-layout-controller. In this case the docking-layout is one of a group of docking-layouts which share that same controller, known as the Docking Group. The panes that can be docked and undocked are shared between the members of the Docking Group. If controller is nil (the default value), the docking-layout is in a Docking Group of one.

A pane pane is dockable in a Docking Group when it is an item of any member of the Docking Group. This is the case when it is one of the items passed to make-instance for some
member of the group, or it has been set in some member by
\((\text{setf docking-layout-items})\). The user can dock and
undock pane in any member of the Docking Group. You can
change the dockable status of panes programmatically by
\((\text{setf docking-layout-items})\). You can query a pane’s
docked and visible status in a docking-layout by docking-
layout-pane-docked-p and docking-layout-pane-visible-p. You can change a pane’s docked and visible status in a
docking-layout by \((\text{setf docking-layout-pane-}
docked-p)\) and \((\text{setf docking-layout-pane-visible-p})\).

By default, the context menu allows the user to alter the visi-
bility status of each of the panes in the Docking Group.

\textit{items} is a list of pane specifications. Each specification in the
list is either an atom denoting a pane, or a list wherein the
\texttt{cl:car} is an object denoting a pane and the
\texttt{cl:cdr} is a plist of options and values. The object denoting the pane can be:

- The pane itself.
- A symbol naming a slot in the interface which contains
  the docking-layout. The value in that slot, which must
  be a pane, is used. Typically the slot name is defined in
  the :panes or :layouts class option in the \texttt{define-}
  interface form.
- A string, denoting a title-pane with that text.
- A list, wherein the car is the name of a pane class and the
cdr is a list of initialization arguments for that class. This
denotes the pane created by applying \texttt{make-instance}
to the list. Note that in this case the list cannot be the item
in the \textit{items} list, because it would be wrongly interpreted
as a list wherein the car denotes a pane directly and the
cdr is a plist of options and values.

When an item in the \textit{items} list is a list, the cdr is a plist of
options and values, which can contain these options:
:title  A string which is title associated with the pane. This is used when the pane is presented to the user, for example in the default context menu.

:docked-p  A boolean specifying whether the pane should be docked. The default value is t. When a pane is not docked and is visible, it is displayed in its own window.

:visible-p  A boolean specifying whether the pane is visible. The default value is t.

:undocked-geometry  A list of four integers specifying the geometry of the pane when undocked, as \((x\ y\ width\ height)\).

:start-new-line-p  A boolean specifying whether to place the pane on a new line in the docking-layout. The default value is nil.

docking-layout-items always returns the items as lists, with the cdr containing the options and values.

docking-test-function is a function of two arguments with a boolean return value. When the user attempts to dock a pane pane in the docking-layout, docking-test-function is called with the docking-layout and pane. If it returns nil, pane is not docked. If it returns true, pane is docked. The default behavior is that all panes under the controller which is the controller in this docking-layout, and only these panes, can be docked.

docking-callback, if non-nil, is a function of three arguments: the docking-layout, the pane and a boolean. This third argument is t when the pane is docked, and nil when the pane is undocked. The default value of docking-callback is nil.
divider-p controls whether a visible edge is drawn around the border of the docking-layout. The default value is nil.

orientation specifies whether the items are laid out horizontally or vertically. The default value is :horizontal.

Example

(example-edit-file "capi/layouts/docking-layout")

See also
docking-layout-pane-docked-p
docking-layout-pane-visible-p

docking-layout-pane-docked-p

Function

Package  capi

Signature  docking-layout-pane-docked-p docking-layout pane &key anywhere => dockedp

Signature  (setf docking-layout-pane-docked-p) dockedp docking-layout pane => dockedp

Arguments  
docking-layout  An instance of docking-layout or a subclass.

pane  A pane.

anywhere  A boolean.

Values  
dockedp  A boolean.

Description  The function docking-layout-pane-docked-p returns a boolean indicating whether pane is currently docked.

If anywhere is t, dockedp is true if pane is docked in any member of the Docking Group of docking-layout. If anywhere is nil, dockedp is true only if pane is docked in docking-layout itself. The default value of anywhere is nil.
(setf docking-layout-pane-docked-p) may be used to change the docking state of pane in docking-layout only when pane is dockable in the Docking Group of docking-layout, that is, it was added to the items of any of the docking-layouts in the group.

See also docking-layout

**docking-layout-pane-visible-p**

<table>
<thead>
<tr>
<th>Package</th>
<th>capi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature</td>
<td>docking-layout-pane-visible-p docking-layout pane =&gt; visiblep</td>
</tr>
<tr>
<td>Signature</td>
<td>(setf docking-layout-pane-visible-p) visiblep docking-layout pane =&gt; visiblep</td>
</tr>
<tr>
<td>Arguments</td>
<td>docking-layout An instance of docking-layout or a subclass. pane A pane.</td>
</tr>
<tr>
<td>Values</td>
<td>visiblep A boolean.</td>
</tr>
<tr>
<td>Description</td>
<td>The function docking-layout-pane-visible-p returns a boolean indicating whether pane is currently visible in the Docking Group of docking-layout. pane may be docked in any member of the Docking Group, or undocked. (setf docking-layout-pane-visible-p) may be used to change the visibility of pane in docking-layout only when pane is dockable in the Docking Group of docking-layout, that is, it was added to the items of any of the docking-layouts in the group.</td>
</tr>
</tbody>
</table>

See also docking-layout
document-container

Class

Package capi

Superclasses capi-object

Readers screen-interfaces

Description The class of the container in a document-frame.
A document container has some screen-like functionality, responding to screen-internal-geometry and screen-active-interface.
This works only in LispWorks for Windows.

See also display
document-frame
screen-active-interface
screen-internal-geometry
“Screens” on page 36
Chapter 10, “Defining Interface Classes - top level windows”

document-frame

Class

Summary The class document-frame is used to implement MDI.
This works only in LispWorks for Windows.

Package capi

Superclasses interface

Readers document-frame-container

Description The class document-frame is used to implement Multiple-Document Interface (MDI) which is a standard technique on Microsoft Windows (see the MSDN for documentation).
To use MDI in the CAPI, define an interface class that inherits from `document-frame`, and use the two special slots `capi:container` and `capi:windows-menu`. For the details and an example, see “Multiple-Document Interface (MDI)” on page 92.

Notes  
`capi:windows-menu` is a special slot in `document-frame` and this symbol should not appear elsewhere in the `define-interface` form.

See also  
current-document  
merge-menu-bars  
“Hierarchy of panes” on page 27  
“Multiple-Document Interface (MDI)” on page 92

double-headed-arrow-pinboard-object  

Class

Summary  
A `pinboard-object` that draws itself as an arrow, which can switch dynamically from double-headed to single-headed.

Package  
capi

Superclasses  
arrow-pinboard-object

Initargs  
`:double-head-predicate`  
A function determining whether a single or double arrowhead is drawn.

Description  
`double-head-predicate` should be a function of two arguments returning a boolean value. The first argument is the output pane on which the arrow pinboard object is drawn. The second argument is the arrow pinboard object itself.
**double-head-predicate** should return a true value if the arrow is to be double-headed, and nil if a single-headed arrow should be drawn. It is called each time the arrow object is redrawn.

**Example**

```lisp
(defun double-head-predicate (x y) *doublep*)
```

```lisp
(let ((dhr
       (capi:contain
        (make-instance 'capi:pinboard-layout
                        :description (list
                                       (make-instance 'capi:double-headed-arrow-pinboard-object
                                                       :double-head-predicate #'(lambda (x y) *doublep*)
                                                       :start-x 5 :start-y 5 :end-x 95 :end-y 95)
                                       (make-instance 'capi:double-headed-arrow-pinboard-object
                                                       :double-head-predicate #'(lambda (x y) *doublep*)
                                                       :head-direction :backwards
                                                       :start-x 5 :start-y 95 :end-x 95 :end-y 5))
                        :visible-min-width 100
                        :visible-min-height 100))
      (dotimes (x 10)
        (sleep 1)
        (setq *doublep* (not *doublep*))
        (mapcar 'capi:redraw-pinboard-object (capi:layout-description dhr))))
```

See also

"Creating graphical objects" on page 187

**double-list-panel**

**Class**

**Summary**

A choice which displays its selected items and its unselected items in disjoint lists displayed in two sub-panels, and facilitates easy movement of items between these lists.

**Package**

capi
Superclasses

choice
interface

Initargs

These initargs are passed to the sub-panels. See the documentation for list-panel for information on how the sub-panels interpret them.

:selected-items-title

:unselected-items-title

\begin{verbatim}
selected-items-title and unselected-items-title are passed as the :title initarg to the list panels.
The default value of selected-items-title is "Selected items:" and the default value of unselected-items-title is "Unselected items:"
\end{verbatim}

:selected-items-filter

:unselected-items-filter

\begin{verbatim}
selected-items-filter and unselected-items-filter are passed as the :filter initarg to the list panels.
The default value of both selected-items-filter and unselected-items-filter is nil.
\end{verbatim}

:list-visible-min-width

:list-visible-min-height

\begin{verbatim}
list-visible-min-width and list-visible-min-height are passed as the :visible-min-width and :visible-min-height initargs to both list panels.
\end{verbatim}

These initargs are passed to both of the sub-panels to specify images. See the documentation for list-panel for information on how the sub-panels interpret them.

:image-function

:image-state-function

:image-width
Description

The class `double-list-panel` is a choice which displays its items in two `list-panel`s. One list contains the selected items and the other contains the unselected items. There is a pair of arrow buttons which move highlighted items between the lists.

The default interaction of `double-list-panel` is `:extended-selection`.

The selection-callback, extend-callback or retract-callback is called as appropriate when items are moved between the lists. There is no action-callback for `double-list-panel`.

The user selects and de-selects items in the `double-list-panel` by moving them between the two lists. There are three ways to move the items:

- Highlight the items to move by normal `list-panel` selection gestures, then press an arrow button.
- Highlight a single item to move by normal `list-panel` selection gestures, then press Return.
- Double click on an item to move it.

Notes

1. `double-list-panel` is not a subclass of `list-panel`.
2. `double-list-panel` does not have image lists. To use sub-images from an `image-set`, use `image-locators`. 
Example

(capi:display
 (make-instance
  'capi:double-list-panel
  :items '("John" "Geoff" "chicken" "blue" "water")
  :selection-callback
  #'(lambda (item choice)
      (capi:display-message "selecting -a" item))
  :extend-callback
  #'(lambda(item choice)
      (capi:display-message "extending -a" item))
  :retract-callback
  #'(lambda(item choice)
      (capi:display-message "deselecting -a" item)))))

See also
list-panel
"List panels" on page 48

drag-pane-object

Function

Summary
Initiates a dragging operation

Package
capi

Signature
drag-pane-object pane value &key string plist image-function
operations => operation

Arguments
pane A pane
value An object to be dragged
string A string to be dragged or nil
plist A plist of formats and objects to be dragged
image-function A function or nil
operations A list of operation keywords allowed for the
dragged objects

Values
operation One of the operation keywords
The function `drag-pane-object` initiates a dragging operation from within the pane `pane`. It can only be called from within the button `:press` or button `:motion` callbacks of the `input-model` of an `output-pane`.

The `value`, `string` and `plist` arguments are combined to provide an object to be dragged in various formats.

`value` can be any Lisp object (not necessarily a string) to make available for dropping into a pane within the local Lisp image.

`string` can be a string representation of `value` to make available, or `nil`. If `string` is `nil` and `value` is a string, then that will be made available as the string.

`plist` is a property list of additional format/value pairs to make available. The currently supported formats are as described for `set-drop-object-supported-formats`. You can make more than one format available simultaneously.

`image-function` provides a graphical image for use during the dragging operation on Cocoa. If `image-function` is supplied, then it should be a function of one argument. It might be called to provide an image for use during the dragging operation. The function `image-function` should return three values: a `image` object, an x offset and a y offset. The x and y offsets are the position within the image where the mouse should be located. If the image is `nil` or `image-function` is not supplied then a default image is generated. If the x or y offsets are `nil` or not returned then the image is positioned with the mouse at its center point. The image that is returned by `image-function` is freed automatically in the end of dragging operation. It must be a new image, and cannot be reused.

`operations` should be a list of operation keywords that the pane will allow the target application to perform. The operation keywords are `:copy`, `:move` and `:link` as described for
the effect in `drop-object-drop-effect`. If certain platform-specific modifier keys are pressed, then some of the operations will be ignored.

The return value `operation` indicates which operation was performed by the application where the dragged object was dropped. The value will be `:none` if the object was not dropped anywhere or dragging was abandoned (for example, by the user hitting the `Escape` key). If `operation` is `:move`, then you should update the data structures in your application to remove the object that was dragged.

**Notes**

1. `drag-pane-object` is not supported on X11/Motif. See `simple-pane` for information about drop callbacks.

2. `image-function` is only called on Cocoa. There is no way to specify an image when dragging on Microsoft Windows.

3. If `:image` is supplied in `plist`, the dragging mechanism automatically frees the `image` object as if by `free-image` when it no longer needs it.

**Example**

(example-edit-file "capi/output-panes/drag-and-drop")

**See also**

`simple-pane`

Chapter 17, “Drag and Drop”

---

**draw-metafile**

**Function**

**Summary**

Draws a metafile to a pane.

**Package**

capi

**Signature**

draw-metafile pane metafile x y width height

**Arguments**

`pane` An `output-pane`. 
**Description**

The function `draw-metafile` draws the metafile `metafile` to the pane `pane` at position `x,y` with size `width, height`.

`metafile` should be a metafile as returned by `with-internal-metafile`.

The `graphics-state` parameters `transform`, `mask` and `mask-transform` affect how the metafile is drawn. The other `graphics-state` parameters are taken from the metafile.

**Notes**

1. `draw-metafile` is supported on GTK+ only where Cairo is supported (GTK+ 2.8 and later).
2. Metfiles look bad on GTK+, because they transform the image rather than the drawing.
3. `draw-metafile` is not implemented on X11/Motif.

**Examples**

```lisp
(example-edit-file "capi/graphics/metafile")
(example-edit-file "capi/graphics/metafile-rotation")
```

**See also**

`can-use-metafile-p`
`clipboard`
`draw-metafile-to-image`
`free-metafile`
`graphics-state`
`with-internal-metafile`

---

**Function**

**draw-metafile-to-image**

**Summary**

Draws a metafile as an image.
Package: capi

Signature: draw-metafile-to-image pane metafile &key width height max-width max-height background alpha => image

Arguments:
- pane: An output-pane.
- metafile: A metafile.
- width, height: Non-negative integers, or nil.
- max-width, max-height: Non-negative integers, or nil.
- background: A color specification.
- alpha: A generalized boolean.

Values:
- image: An image.

Description: The function draw-metafile-to-image returns a new image object for pane, with metafile drawn into the image. metafile should be a metafile as returned by with-internal-metafile.

If width and height are both nil then the size of the image is computed from the metafile. If both width and height are integers, then they specify the size of the image and the metafile is scaled to fit. If one of width or height is nil, then it is computed from the other dimension, preserving the aspect ratio of the metafile. The default values of width and height are both nil.

The max-width and max-height arguments, if non-nil, constrain the computed or specified values of width and height respectively. The aspect ratio is retained when the size is constrained, so specifying a max-width can also reduce the actual height of the image. The default values of max-width and max-height are both nil.
background should be a color spec, which controls the non-drawn parts of the image. For information about color specs, see “Color specs” on page 243. If background is omitted, then the background color of pane is used (see simple-pane).

If alpha is non-nil, then the image will have an alpha component. The default value of alpha is nil.

Notes
1. draw-metafile-to-image is supported on GTK+ only where Cairo is supported (GTK+ 2.8 and later).
2. Metafiles look bad on GTK+, because they transform the image rather than the drawing.
3. draw-metafile-to-image is not implemented on X11/Motif.

See also
clipboard
draw-metafile
free-metafile
with-internal-metafile

draw-pinboard-layout-objects

Function

Summary
Draws the pinboard objects which intersect a given rectangle in a pinboard-layout.

Package
capi

Signature
draw-pinboard-layout-objects pinboard-layout graphics-port x y width height => nil

Arguments
pinboard-layout A pinboard-layout.
graphics-port A graphics port.
x, y, width, height Non-negative integers.

Values
draw-pinboard-layout-objects returns nil.
The function `draw-pinboard-layout-objects` draws the pinboard objects in `pinboard-layout` which intersect the rectangle specified by `x`, `y`, `width` and `height` into the graphics port `graphics-port`.

`graphics-port` can be `pinboard-layout` itself or another graphics port. The drawing is done into the target rectangle, but may also draw outside it.

Notes

1. `draw-pinboard-layout-objects` is used by `pinboard-layout` when it actually needs to display the objects.
2. `draw-pinboard-layout-objects` does not do any caching. The `display-callback` of `pinboard-layout` does any caching, and may use `draw-pinboard-layout-objects` to draw into a cache (a pixmap) rather than the screen.
3. `draw-pinboard-layout-objects` is useful when you want to have your own `display-callback` for a `pinboard-layout` or a subclass. It is possible to use a graphics transformation on `graphics-port` around the call to `draw-pinboard-layout-objects` to affect the drawing. For example `with-graphics-translation` can be used to move the drawing to the origin.

See also

- `pinboard-layout`
- `pinboard-layout-display`
- Chapter 12, “Creating Panes with Your Own Drawing and Input”

**draw-pinboard-object**

*Generic Function*

**Summary**

Draws a pinboard object.

**Package**

capi

**Signature**

draw-pinboard-object pinboard object &key x y width height &allow-other-keys
The generic function `draw-pinboard-object` is called whenever a pinboard object needs to be drawn. The `x`, `y`, `width` and `height` arguments indicate the region that needs to be redrawn, but a method is free to ignore these and draw the complete object. However, it should not draw outside the pinboard object’s bounds.

```
(example-edit-file "capi/graphics/circled-graph-nodes")
```

See also `pinboard-layout`, `pinboard-object`, `pinboard-object-highlighted-p`

---

draw-pinboard-object-highlighted

**Generic Function**

*Summary* Draws highlighting on a pre-drawn pinboard object.

*Package* `capi`

*Signature* `draw-pinboard-object-highlighted pinboard object &key &allow-other-keys`

*Description* The generic function `draw-pinboard-object-highlighted` draws the highlighting onto a pinboard object that has already been drawn. The default highlighting method draws a box around the object, and should be sufficient for most purposes.

```
(example-edit-file "capi/graphics/circled-graph-nodes")
```

See also `highlight-pinboard-object`
drawn-pinboard-object

Summary
The class `drawn-pinboard-object` is a subclass of `pinboard-object` which is drawn by a supplied function, and is provided as a means of the user creating their own pinboard objects.

Package
capi

Superclasses
pinboard-object

Initargs
:display-callback
Called to display the object.

Accessors
drawn-pinboard-object-display-callback

Description
The `display-callback` is called with the output pane to draw on, the `drawn-pinboard-object` itself, and the `x`, `y`, `width` and `height` of the object, and it is expected to redraw that section. The `display-callback` should not draw outside the object’s bounds.

An alternative way of doing this is to create a subclass of `pinboard-object` and to provide a method for `draw-pinboard-object`.

Example
```lisp
(defun draw-an-ellipse
  (output-pane self x y width height)
  (let ((x-radius (floor width 2))
        (y-radius (floor height 2)))
    (gp:draw-ellipse output-pane
                     (+ x x-radius) (+ y y-radius)
                     x-radius y-radius
                     :foreground :red
                     :filled t)))
```
(capi:contain (make-instance
    'capi:drawn-pinboard-object
    :visible-min-width 200
    :visible-min-height 100
    :display-callback 'draw-an-ellipse))

There are further examples in Chapter 20, “Self-contained examples”.

See also pinboard-layout
Chapter 12, “Creating Panes with Your Own Drawing and Input”

drop-object-allows-drop-effect-p

Function

Summary Queries whether a dropping operation can be performed with a given effect.

Package capi

Signature drop-object-allows-drop-effect-p drop-object effect => result

Arguments drop-object A drop-object, as passed to the drop-callback.

effect An effect keyword

Values result A boolean

Description The function drop-object-allows-drop-effect-p returns non-nil if the dropping operation can be performed with the given effect effect. It returns nil if the dropping operation cannot be performed. See drop-object-drop-effect for information on drop effect keywords.

Notes drop-object-allows-drop-effect-p should only be called within a drop-callback. It is not supported on X11/Motif. See simple-pane for information about drop callbacks.
See also  
drop-object-drop-effect  
simple-pane

\textit{drop-object-collection-index} \hspace{1cm} \textit{Function}

\textbf{Summary} \hspace{1cm} Gets the index and relative place in the \textit{collection} that an object is being dropped over.

\textbf{Signature} \hspace{1cm} \texttt{drop-object-collection-index \_drop-object \_\_=> \_index, \_placement}

\texttt{(setf (drop-object-collection-index \_drop-object) (values \_new-index \_new-placement))}

\textbf{Arguments} \hspace{1cm} \texttt{drop-object} \hspace{0.5cm} A \textit{drop-object}, as passed to the \textit{drop-callback}.
\hspace{1cm} \texttt{new-index} \hspace{0.5cm} An integer.
\hspace{1cm} \texttt{new-placement} \hspace{0.5cm} One of \texttt{:above, :item or :below}.

\textbf{Values} \hspace{1cm} \texttt{index} \hspace{0.5cm} An integer.
\hspace{1cm} \texttt{placement} \hspace{0.5cm} One of \texttt{:above, :item or :below}.

\textbf{Description} \hspace{1cm} The function \texttt{drop-object-collection-index} returns the index and place relative to that index within the \textit{collection} that the object \texttt{drop-object} is being dropped over. This information is only meaningful when the pane is an instance of \texttt{list-pane} or \texttt{tree-view}.

The returned value \texttt{index} is the position in the \textit{collection} (see \texttt{get-collection-item} or \texttt{choice-selection}). The returned value \texttt{placement} indicates whether the user is dropping above, on or below the item at \texttt{index}.

There is also a \texttt{setf} expander that can be called with these two values within the \texttt{:drag} stage of the operation, to adjust where the user will be allowed to drop the object.
Notes  \texttt{drop-object-collection-index} should only be called within a \texttt{drop-callback}. It is not supported on X11/Motif. See \texttt{simple-pane} for information about drop callbacks.

Example For an example illustrating the use of drag and drop in a \texttt{choice}, see:

\begin{verbatim}
(example-edit-file "capi/choice/drag-and-drop")
\end{verbatim}

See also \texttt{drop-object-collection-item}

Chapter 17, “Drag and Drop”

\begin{description}
\item[\texttt{drop-object-collection-item}] \textit{Function}
\item[Summary] Gets the item and relative place in the \texttt{collection} that an object is being dropped over.
\item[Signature] \texttt{drop-object-collection-item drop-object => item, placement}
\item[Signature] \{\texttt{setf (drop-object-collection-item drop-object) (values new-item new-placement)}\}
\item[Arguments] \texttt{drop-object} \hspace{1em} A \texttt{drop-object}, as passed to the \texttt{drop-callback}.
\texttt{new-item} \hspace{1em} An item of a \texttt{collection}.
\texttt{new-placement} \hspace{1em} One of \texttt{:above}, \texttt{:item} or \texttt{:below}.
\item[Values] \texttt{item} \hspace{1em} An item of a \texttt{collection}.
\texttt{placement} \hspace{1em} One of \texttt{:above}, \texttt{:item} or \texttt{:below}.
\item[Description] The function \texttt{drop-object-collection-item} returns the item and place relative to that item within the \texttt{collection} that the object \texttt{drop-object} is being dropped over. This information is only meaningful when the pane is an instance of \texttt{list-panel} or \texttt{tree-view}.

The returned value \texttt{placement} indicates whether the user is dropping above, on or below the item.
There is also a setf expander that can be called with these two values within the :drag stage of the operation, to adjust where the user will be allowed to drop the object.

Notes  
drop-object-collection-item should only be called within a drop-callback. It is not supported on X11/Motif. See simple-pane for information about drop callbacks.

Example  
For an example illustrating the use of drag and drop in a choice, see:

(exexample-edit-file "capi/choice/drag-and-drop")

See also  
drop-object-collection-index  
Chapter 17, “Drag and Drop”

drop-object-drop-effect  

Function

Summary  
Reads or sets the current effect of a dropping operation.

Package  
capi

Signature  
drop-object-drop-effect drop-object => effect

Signature  
(setf drop-object-drop-effect) effect drop-object => effect

Arguments  
drop-object  
A drop-object, as passed to the drop-callback.

Values  
effect  
An effect keyword

Description  
The function drop-object-drop-effect gets or sets the current effect of the dropping operation. effect can be one of:

:copy  
The object will be copied. This is the most common value for operations between applications.
The object will be moved. This is usually triggered by the user dragging with a platform-specific modifier key pressed.

A link to the object will be created. This is usually triggered by the user dragging with a platform-specific modifier key pressed.

No dragging is possible.

Notes

`drop-object-drop-effect` should only be called within a `drop-callback`. It is not supported on X11/Motif. See `simple-pane` for information about drop callbacks.

Example

(example-edit-file "capi/output-panes/drag-and-drop")

See also

`simple-pane`

Chapter 17, “Drag and Drop”

**drop-object-get-object**

*Function*

**Summary**

Returns a dropped object in a given format

**Package**

capi

**Signature**

`drop-object-get-object drop-object pane format &rest args => object`

**Arguments**

- `drop-object` A `drop-object`, as passed to the `drop-callback`.
- `pane` A CAPI pane.
- `format` A format keyword.

**Values**

- `object` An object in the given format.

**Description**

The function `drop-object-get-object` returns the dropped object in the given format. See `set-drop-object-supported-formats` for information on format keywords.
Notes

1. When receiving an image (by calling `drop-object-get-object` with the :image format), the received image should also be freed when you finish with it. However, it will be freed automatically when the pane supplied to `drop-object-get-object` is destroyed, so normally you do not need to free it explicitly.

2. `drop-object-get-object` should only be called within a drop-callback, passing the drop-object and pane arguments. It is not supported on X11/Motif. See `simple-pane` for information about drop callbacks.

Example

```lisp
(example-edit-file "capi/output-panes/drag-and-drop")
(example-edit-file "capi/choice/list-panel-drag-images")
```

See also

- `set-drop-object-supported-formats`
- `simple-pane`
- Chapter 17, “Drag and Drop”

**drop-object-pane-x**

**drop-object-pane-y**

*Generic Functions*

**Summary**

Gets the coordinates in the pane that an object is being dropped over.

**Package**

`capi`

**Signature**

`drop-object-pane-x drop-object => x-coord`

`drop-object-pane-y drop-object => y-coord`

**Arguments**

`drop-object` A drop-object, as passed to the drop-callback.

**Values**

`x-coord, y-coord` Integers.
Description

The accessor functions `drop-object-pane-x` and `drop-object-pane-y` return the x and y coordinates within the pane that the object is being dropped over. This information is only meaningful when the pane is an instance of `output-pane` or one of its subclasses.

Notes

`drop-object-pane-x` and `drop-object-pane-y` should only be called within a `drop-callback`. They are not supported on X11/Motif. See `simple-pane` for information about drop callbacks.

See also

`simple-pane`
Chapter 17, “Drag and Drop”

**drop-object-provides-format**

*Function*

Summary

Queries whether a dropping operation can provide an object in a given format.

Package

capi

Signature

drop-object-provides-format drop-object format => result

Arguments

drop-object A drop-object, as passed to the drop-callback.

format A format keyword

Values

result A boolean

Description

The function `drop-object-provides-format` returns non-nil if the dropping operation can provide an object in the given format. It returns `nil` if it cannot provide that format. See `set-drop-object-supported-formats` for information on format keywords.
Notes  drop-object-provides-format should only be called within a drop-callback. It is not supported on X11/Motif. See simple-pane for information about drop callbacks.

Example  (example-edit-file "capi/output-panes/drag-and-drop")

See also  set-drop-object-supported-formats

simple-pane

Chapter 17, “Drag and Drop”

*echo-area-cursor-inactive-style*  Variable

Summary  The drawing style of the Echo Area cursor when the window is inactive.

Package  capi

Initial Value  :invisible

Description  The drawing style of the cursor in the Echo Area of an inactive window in the LispWorks IDE.

The allowed values are :inverse, :outline, :underline and :invisible.

echo-area-pane  Class

Summary  The class of the Editor’s echo area.

Package  capi

Superclasses  editor-pane

Description  The class echo-area-pane is used to implement the small window for user interaction, known as the Echo Area, which is at the bottom of Editor windows in the LispWorks IDE.
You should not normally need to work with this class directly. To add an Echo Area, pass `:echo-area t` when making the `editor-pane`.

---

**`*editor-cursor-active-style*`**

*Variable*

<table>
<thead>
<tr>
<th>Summary</th>
<th>The drawing style of the editor’s cursor when the window is active.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td><code>capi</code></td>
</tr>
<tr>
<td>Initial Value</td>
<td><code>:inverse</code></td>
</tr>
<tr>
<td>Description</td>
<td>The drawing style of an <code>editor-pane</code> cursor when the window is active. The allowed values are <code>:inverse</code>, <code>:outline</code>, <code>:underline</code>, <code>:left-bar</code> and <code>:caret</code>.</td>
</tr>
<tr>
<td>See also</td>
<td><code>editor-pane-blink-rate</code></td>
</tr>
</tbody>
</table>

---

**`*editor-cursor-color*`**

*Variable*

<table>
<thead>
<tr>
<th>Summary</th>
<th>The background color of the cursor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td><code>capi</code></td>
</tr>
<tr>
<td>Initial Value</td>
<td><code>nil</code></td>
</tr>
<tr>
<td>Description</td>
<td>When non-nil, the value is a color spec or color alias determining the background color of the <code>editor-pane</code> cursor. See Chapter 15, “The Color System” for information about color specs and aliases.</td>
</tr>
</tbody>
</table>
The value `nil` means that the cursor background color is the same as the `foreground` color of the editor pane. `foreground` is a slot inherited from `simple-pane`.

Example

```
(setf capi:*editor-cursor-color* :red)
```

### *editor-cursor-drag-style* Variable

**Summary**

The drawing style of the editor’s cursor during a selection drag.

**Package**

capi

**Initial Value**

`:left-bar`

**Description**

The drawing style of an `editor-pane` cursor during a selection drag.

The allowed values are `:inverse`, `:outline`, `:underline`, `:left-bar` and `:caret`.

### *editor-cursor-inactive-style* Variable

**Summary**

The drawing style of the editor’s cursor when the window is inactive.

**Package**

capi

**Initial Value**

`:outline`

**Description**

The drawing style of an `editor-pane` cursor when the window is inactive.

The allowed values are `:inverse`, `:outline`, `:underline` or `:invisible`. 
See also  editor-pane

editor-pane  

Class

Summary  An editor pane is an editor that has all of the functionality described in the *LispWorks Guide To The Editor*.

Package  capi

Superclasses  output-pane

Subclasses  interactive-pane  
        collector-pane

Initargs  
        :text  A string or nil.
        :enabled  t, nil or :read-only.
        :buffer-modes  A list specifying the modes of the editor buffer.
        :buffer-name  A string, an editor buffer or the keyword :temp.
        :buffer  A synonym for the initarg :buffer-name.
        :change-callback  A function designator, or nil.
        :before-input-callback  A function designator, or nil.
        :after-input-callback  A function designator, or nil.
        :echo-area  A flag determining whether the editor pane has an Echo Area.
        :fixed-fill  An integer specifying the fill length, or nil.
        :flag  A non-keyword symbol.
:line-wrap-marker
A character, or nil.

:line-wrap-face
An editor:face object, or a symbol naming a face, or nil.

:wrap-style  nil, t or the keyword :split-on-space.

:composition-face
Changes the editor face that is used by editor-pane-default-composition-callback to display the composition string. The default value is :default.

Accessors
editor-pane-text
editor-pane-change-callback
editor-pane-enabled
editor-pane-fixed-fill
editor-pane-line-wrap-marker
editor-pane-line-wrap-face
editor-pane-wrap-style
editor-pane-composition-face

Description
enabled controls how user input affects the editor-pane. If enabled is nil, all input from the mouse and keyboard is ignored. When enabled is t, all input is processed according to the input-model. When enabled is :read-only, input to the pane by keyboard or mouse gestures cannot change the text. More accurately, input via the default input-model of editor-pane cannot change the text. The Cut and Paste menu entries are also disabled. When a user tries to change the text, the operation quietly aborts. Programmatic modifications of the text are still allowed (see Notes below for more detail).

The enabled state can be set by the accessor editor-pane-enabled. capi:simple-pane-enabled has the same effect when applied to an editor-pane.
The pane stores text in buffers which are uniquely named, and so to create an editor-pane using an existing buffer you should pass the buffer-name. To create an editor-pane with a new buffer, use either flag or a non-empty text string or a buffer-name that does not match any existing buffer.

buffer-name can also be an editor buffer naming itself.

buffer-name can also be the keyword :temp. In this case the editor-pane will be created with a temporary buffer that will go away when the editor-pane is Garbage Collected (it is created by editor:make-buffer with :temporary t).

A non-empty string value of text specifies the initial text displayed and forces the creation of a new buffer. The accessor editor-pane-text is provided to read and write the text in the editor buffer.

buffer-modes allows you to specify the initial major mode and minor modes of the editor-pane’s buffer. It should be a list of the form (major-mode-name . minor-mode-names). See the LispWorks Editor User Guide for a description of major and minor modes in the LispWorks editor. buffer-modes is used only when the CAPI creates the buffer, and not when it reuses a buffer.

If echo-area is non-nil, then an Echo Area is added. echo-area defaults to nil.

If fixed-fill is non-nil, the editor pane tries to form lines of length close to, but no more than, fixed-fill. It does this by forcing line breaks at spaces between words. fixed-fill defaults to nil.

The cursor in an editor-pane blinks on and off by the mechanism described in editor-pane-blink-rate.

change-callback, if non-nil, should be a function which is called whenever the editor buffer under the editor-pane changes. For the details see “Editor pane callbacks” on page 24.
before-input-callback and after-input-callback, if non-nil, should be functions which are called when call-editor is called. For the details see “Editor pane callbacks” on page 24.

line-wrap-marker specifies the marker to display at the end of a line that is wrapped to the next line, or truncated if wrap-style is nil. The value must be a character, or nil (which is interpreted as \Space). The default value is the value of *default-editor-pane-line-wrap-marker*. The value can be read by editor-pane-line-wrap-marker.

line-wrap-face specifies a face to use when displaying the line-wrap-marker. The argument can be nil, an editor:face object (the result of a call to editor:make-face), or a symbol naming a face (that is, the first argument to editor:make-face).

The default value of line-wrap-face is an internal symbol naming a face. The value can be accessed by editor-pane-line-wrap-face. The default face can be modified in the LispWorks IDE via Tools > Preferences... > Environment > Styles > Colors and Attributes, style name Line Wrap Marker.

wrap-style defines the wrapping of text lines that cannot be displayed in one line of the editor-pane. The argument can be one of:

- \texttt{t} Normal wrapping. Display as many characters as possible in the editor-pane line.
- \texttt{nil} Do not wrap. Text lines that are too long are truncated.
- \texttt{:split-on-space} Wrapping, but attempts to split lines on spaces. When the text reaches the end of a line, the code looks backwards for space, and wraps before it.

The default value of wrap-style is \texttt{t} and the value can accessed by editor-pane-wrap-style.
The input behavior of an editor-pane is determined by its input-model (inherited from output-pane). By default, an editor-pane has an input-model that implements the functionality of the Editor tool in the LispWorks IDE, and always does it via call-editor. You can replace this behavior by supplying :input-model when you call make-instance or by (setf capi:output-pane-input-model), though this has an effect only if called before the pane is displayed. It is possible to achieve a minor modification to the default input behavior by prepending the modification (see the example below). Note that functions performing editor operations must do this via call-editor.

Editor panes support GNU Emacs keys on all platforms. Additionally on Microsoft Windows they support Windows editor keys, on GTK+ and Motif they support KDE/Gnome keys, and on Cocoa they support Mac OS X editor keys. Exactly one style of emulation is active at any one time for each editor pane. By default, editor panes in the LispWorks IDE use Emacs emulation on all platforms. By default, editor panes in delivered applications use Windows emulation on Microsoft Windows, Mac OS X editor emulation on Cocoa, and Emacs emulation on GTK+ and Motif. To alter the choice of emulation, see interface-keys-style or the deliver keyword :editor-style, described in the LispWorks Delivery User Guide.

Notes


2. For an editor-pane with enabled :read-only, Editor commands (predefined, and user-defined by editor:defcommand) may or may not be able to change the text, depending on how they are called. When executed by a key sequence they cannot change the text directly.
However Editor commands can also be called via editor:process-character or call-editor, and then are programmatic input and so can change the text.

3. The effect of enabled :read-only is on the editor-pane. It does not affect the underlying Editor buffer, which can still be modified from other panes. The buffer that is displayed can be changed, and this does not affect the enabled state of the editor-pane.

4. Except when actually editing a file, it is normally best to use a temporary buffer when using an editor-pane, supplying :buffer-name :temp (or :buffer-name tb, where tb is created by editor:make-buffer with :temporary t). This prevents auto-saving and sharing buffers unintentionally.

5. To control whether the native input method is used to interpret keyboard input, you can supply the output-pane initarg :use-native-input-method or call set-default-use-native-input-method.

6. The default value of composition-callback (see output-pane) is editor-pane-default-composition-callback.

Compatibility note

In LispWorks 4.4 and previous versions editor-pane supports only fixed-width fonts.

On Cocoa, editor-pane supports only fixed-width fonts in LispWorks 6.1 and earlier versions.

In LispWorks 6.1 and later versions, variable-width fonts can be used on Microsoft Windows, GTK+ and Motif. In LispWorks 7.0 and later, variable-width fonts can also be used on Cocoa. Specify the font via the :font initarg (see simple-pane).

The initarg :wrap-style supersedes editor:set-window-split-on-space, which is deprecated.
Example

{(capi:contain (make-instance 'capi:editor-pane
 :text "Hello world"
 :buffer-name :temp))

(setq ed (capi:contain
 (make-instance 'capi:editor-pane
 :text "Hello world"
 :enabled nil
 :buffer-name :temp)))

Note that you cannot type into the editor pane.

{(capi:apply-in-pane-process
 ed #'(setf capi:editor-pane-enabled) t ed)

Now you can enter text into the editor pane interactively.

You can also change the text programmatically:

{(capi:apply-in-pane-process
 ed #'(setf capi:editor-pane-text) "New text" ed)

In this example the callback modifies the buffer in the correct editor context so you that see the editor update immediately:
(capi:define-interface updating-editor ()
 ()
 (:panes
  (numbers capi:list-panel
   :items '(1 2 3)
   :selection-callback 'update-editor
   :callback-type :interface
   :visible-min-height '(:character 3))
  (editor capi:editor-pane
   :text
   "Select numbers in the list above."
   :visible-min-width
   (list :character 35)
   :buffer-name :temp)))

(defun update-editor (interface)
  (with-slots (numbers editor) interface
    (editor:process-character
     (list #'(setf capi:editor-pane-text)
        (format nil "-R" (capi:choice-selected-item numbers))
        editor)
     (capi:editor-window editor))))

(capi:display (make-instance 'updating-editor))

This example illustrates the use of buffer-modes to specify a major mode:
(defclass my-lisp-editor (capi:editor-pane) ()
  (:default-initargs
    :buffer-modes '("Lisp")
    :echo-area t
    :text
    ;; Lisp mode functionality such as command bindings
    ;; and parenthesis balancing work in this window.
    ;; Ensure Emacs-like bindings regardless of platform
    :visible-min-width '(:character 60)
    :name "My Lisp Editor Pane")

(capi:define-interface my-lisp-editor-interface ()
  ()
  (:panes
    (ed
     my-lisp-editor
    ))
  (:default-initargs
    :title "My Lisp Editor Interface")

(capi:display
  (make-instance 'my-lisp-editor-interface))

This example makes an editor-pane with no input behavior:

(capi:contain
  (make-instance 'capi:editor-pane
    :input-model nil
    :buffer-name :temp))

This example makes an editor-pane with the default input behavior, except that pressing the mouse button displays a message rather than setting the point. It then displays the pane:
(progn
  (defun foo (self x y)
    (capi:display-message "Button-1 Press at ~a/~a" x y))
  (let ((ep (make-instance 'capi:editor-pane :buffer-name :temp)))
    (setq (capi:output-pane-input-model ep)
      (list* '((:button-1 :press) foo)
        (capi:output-pane-input-model ep)))
    (capi:contain ep)))

Also see these examples:

(exemple-edit-file "capi/editor/*")

See also
call-editor
*default-editor-pane-line-wrap-marker*
capi:editor-pane-blink-rate
*editor-cursor-active-style*
*editor-cursor-inactive-style*
*editor-cursor-color*
*editor-cursor-drag-style*
*editor-cursor-inactive-style*
interface-keys-style
modify-editor-pane-buffer
output-pane
set-default-use-native-input-method
"Displaying and entering text” on page 20
"In-place completion” on page 168

editor-pane-blink-rate

Generic Function

Summary
Returns the cursor blinking rate for an editor pane.

Package
capi

Signature
editor-pane-blink-rate self => blink-rate

Arguments
self An editor pane.
Values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>blink-rate</td>
<td>A non-negative real number, or nil.</td>
</tr>
</tbody>
</table>

Description

The system calls the function `editor-pane-blink-rate` to determine the cursor blinking rate in milliseconds. The pane uses the value `blink-rate` each time it gets the focus.

If `blink-rate` is a positive real number, then it is the blinking rate in milliseconds. If `blink-rate` is 0, then there is no blinking. If `blink-rate` is `nil`, then the default blinking rate is used.

The default method on `editor-pane-blink-rate` returns `nil`, which means use the default blinking rate. `set-default-editor-pane-blink-rate`.

You can define your own methods on `editor-pane-blink-rate` for `editor-pane` and subclasses thereof.

See also

* `*editor-cursor-active-style*`  
* `editor-pane`  
* `editor-pane-native-blink-rate`  
* `set-default-editor-pane-blink-rate`  

“Displaying and entering text” on page 20

---

**editor-pane-buffer**

*Function*

Summary

Returns the editor buffer associated with an editor pane.

Package

capi

Signature

`editor-pane-buffer pane`

Description

The function `editor-pane-buffer` returns the editor buffer associated with an editor pane, which can be manipulated in the standard ways with the routines in the editor package.

Example

```lisp
(setq editor-pane
  (capi:contain (make-instance 'capi:editor-pane
                             :text "Hello world")))
```
(setq buffer
  (capi:editor-pane-buffer editor-pane))

(editor:insert-string (editor:buffers-end buffer)
 (format nil "-Here's some more text..."))

See also editor-pane

*editor-pane-composition-selected-range-face-plist* Variable

Summary Can modify the face of the default editor composition string.

Initial Value (:inverse-p t)

Description The variable *editor-pane-composition-selected-range-face-plist* is a plist that is used to modify the face of the composition string when :selected-range and :selection-needs-face are passed in the plist to editor-pane-default-composition-callback. The plist is merged into the plist that is passed into editor-pane-default-composition-callback, so keywords in it override the keywords in the face.

See also editor-pane-default-composition-callback

editor-pane-default-composition-callback Function

Summary The default composition callback of the editor. Composition here means composing input characters into other characters by an input method.

Signature editor-pane-default-composition-callback editor-pane what

Description The function editor-pane-default-composition-callback is the default composition-callback of editor-pane. It may also be called by your program.
When called with `what = :start`, *editor-pane-default-composition-callback* sets the composition placement in the editor by calling *set-composition-placement*, and also makes it move the composition window following the user’s mouse cursor movement.

When called with `what = :end`, it stops the following of the mouse cursor.

When called with a list (which needs to be a plist), *editor-pane-default-composition-callback* checks if it contains a keyword/value pair for `:string-face-lists`, and if it does displays it in the editor temporarily (until the next call to it). See the entry for *output-pane* for the description of the value `string-face-lists`.

By default, *editor-pane-default-composition-callback* uses the faces that are supplied in `string-face-lists`, but if the plist contains `:selection-needs-face` and `:selected-range`, it displays the selected range with a different face, by merging `*editor-pane-composition-selected-range-face-plist*` into the given face of the selected range.

This can be overridden by setting the `composition-face` in the *editor-pane*, or the global `*editor-pane-default-composition-face*` if the `composition-face` of the pane is `:default`.

If `composition-face` is a true value then the exact behavior depends on its type:

**A plist**

This is appended to each face plist in the the `string-face-lists`. In other words, it provides default values for the attributes of the face.

**An editor:face**

Overrides the supplied face completely.
A function or a symbol

For string-face-list, funcalls it with two arguments, the pane and the supplied face plist, and uses the result (which may be an editor:face or a face plist).

editor-pane-default-composition-callback is the default value of composition-callback for editor-pane. This can be overridden by passing :composition-callback or using output-pane-composition-callback (see entry for output-pane).

The user-supplied callback may call editor-pane-default-composition-callback to do the actual display, potentially after modifying the argument when it is a plist.

See also set-composition-placement

*editor-pane-default-composition-face*

Variable

Summary

The default composition face for editor-pane.

Initial Value

nil

Description

The variable *editor-pane-default-composition-face* gives the default composition face for all editor-panes where the composition-face is set to :default.

:default is the default value for composition-face, so normally setting this variable affects the composition-face of all editor-panes.

See editor-pane-default-composition-callback for a description of how it is used.

See also editor-pane-default-composition-callback
editor-pane-native-blink-rate

Function

Summary
Returns the native cursor blinking rate for an editor-pane.

Package
capi

Signature
editor-pane-native-blink-rate pane => blink-rate

Arguments
pane An editor-pane.

Values
blink-rate A non-negative real number, or nil.

Description
The function editor-pane-native-blink-rate returns the native cursor blinking rate for the editor-pane pane, that is the rate that the GUI library (Motif, Microsoft Windows, Cocoa) uses.

The value blink-rate is interpreted as a blinking rate as described in editor-pane-blink-rate.

See also
editor-pane-blink-rate
set-default-editor-pane-blink-rate

editor-pane-selected-text

Generic Function

Summary
Returns the selected text in an editor-pane.

Package
capi

Signature
editor-pane-selected-text editor-pane => result

Arguments
editor-pane An editor-pane.

Values
result A string or nil.
The function `editor-pane-selected-text` takes an instance of `editor-pane` as its argument and returns the selected text in `editor-pane`, or `nil` if there is no selection.

See also `editor-pane`  
`editor-pane-selected-text-p`  

### `editor-pane-selected-text-p`  
**Generic Function**

**Summary**
The predicate for a current selection in an `editor-pane`.

**Package**  
capi

**Signature**
`editor-pane-selected-text-p`  
`editor-pane`  
`=>`  
`result`

**Arguments**
`editor-pane`  
An `editor-pane`.

**Values**
`result`  
A boolean.

**Description**
The generic function `editor-pane-selected-text-p` takes an instance of `editor-pane` as its argument and returns `t` if there is text currently selected in `editor-pane`, or `nil` if there is no selection.

See also `editor-pane`  
`editor-pane-selected-text`

### `editor-pane-stream`  
**Generic Function**

**Summary**
Returns the output stream associated with an editor pane.

**Package**  
capi

**Signature**
`editor-pane-stream`  
`editor-pane`  
`=>`  
`stream`
Arguments  
editor-pane  
An editor-pane.

Values  
stream  
An output stream.

Description  
The generic function `editor-pane-stream` returns the stream where the results of evaluation in the editor buffer currently associated with `pane` are printed to.

See also  
editor-pane

editor-window  
Generic Function

Summary  
Returns the editor window object.

Package  
capi

Signature  
editor-window editor => editor-window

Arguments  
editor  
An editor-pane or an Editor interface in the LispWorks IDE.

Values  
editor-window  
An editor window object.

Description  
The generic function `editor-window` returns the editor window object associated with `editor`.  
The functionality of editor windows is documented in the *LispWorks Editor User Guide*.

See also  
editor-pane

element  
Class

Summary  
The class `element` is the superclass of all CAPI objects that appear in a window.
Package: capi
Superclasses: capi-object
Subclasses: simple-pane, menu

Initargs:
- :parent The element containing this element.
- :interface The interface containing this element.
- :accepts-focus-p Specifies that the element should accept input.
- :help-key An object used for lookup of help. Default value t.
- :widget-name A string designator.
- :initial-constraints Specifies constraints (geometry hints) that apply to the element during the creation of the element's interface, but not after the interface is displayed.

The following initargs are geometry hints, influencing the initial size and position of an element and constraining its size:
- :x The x position of the element in a pinboard.
- :y The y position of the element in a pinboard.
- :external-min-width The minimum width of the element in its parent.
- :external-min-height The minimum height of the element in its parent.
:external-max-width
The maximum width of the element in its parent.

:external-max-height
The maximum height of the element in its parent.

:visible-min-width
The minimum visible width of the element.

:visible-min-height
The minimum visible height of the element.

:visible-max-width
The maximum visible width of the element.

:visible-max-height
The maximum visible height of the element.

:internal-min-width
The minimum width of the display region.

:internal-min-height
The minimum height of the display region.

:internal-max-width
The maximum width of the display region.

:internal-max-height
The maximum height of the display region.

Accessors

   element-parent
   element-widget-name

Readers

   element-interface
   help-key

Description

The class element contains the slots parent and interface which contain the element and the interface that the element is contained in respectively. The writer method element-parent can be used to re-parent an element into
another parent (or to remove it from a container entirely by setting its parent to nil). Note that an element should not be used in more than one place at a time.

The initarg accepts-focus-p specifies that the element can accept input. The default value is t. In some subclasses including display-pane and title-pane the default value of accepts-focus-p is nil. A pane accepts the input focus if and only if the function accepts-focus-p returns true.

accepts-focus-p also influences whether a pane is a tabstop on Microsoft Windows, where a pane acts as a tabstop if and only if the function accepts-focus-p returns true and the :accepts-focus-p initarg value is :force. On Motif and Cocoa, a pane acts as a tabstop if and only if the function accepts-focus-p returns true.

help-key is used to determine how help is displayed for the pane. The value nil means that no help is displayed. Otherwise, help-key is passed to the help-callback, except when help-key is t, when the name of the pane is passed to the help-callback. For details of help-callback, see interface.

widget-name specifies the widget name of the element. This is used to match resources on GTK+ and Motif. Note that this name will be in the path only if the element has a representation. tab-layout and pinboard-layout always have a representation, as do all elements that show anything on the screen. Other layouts may or may not have a representation and so you should not supply widget-name for these.

The actual widget name is the result of a call to cl:string, except when widget-name is a symbol, in which case the symbol name is downcased to derive the widget name.

If widget-name is not supplied, the system constructs a default widget name which is the name of the class of the widget (downcased), except for top level interfaces on GTK+ where the application-class is prepended followed by a dot.
Example GTK+ resource files are in `lib/7-0-0-0/examples/gtk/`

**Note:** When `widget-name` is supplied, the GTK+ library does not prepend the `application-class`.

The accessor `element-widget-name` gets and (with `setf`) sets the `widget-name`. `widget-name` is used when the widget is created, that is when `display` is called on the top level interface of the element. Setting `widget-name` afterwards has no effect.

All elements accept `initargs` (listed above) representing hints as to the initial size and position of the element. By default elements have a minimum pixel size of one by one, and a maximum size of `nil` (meaning no maximum), but the hints can be specified to change these values. For the detailed interpretation of, and possible values for, these hints see “Width and height hints” on page 80.

### Notes

1. Some classes have default `initargs` providing useful hints. For example, `display-pane` has `:text-height` as the default value of `:visible-min-height`, ensuring that the text is visible.

2. The `ratios`, `x-ratios` and `y-ratios` settings in some layouts (for example `grid-layout`) also control the actual size of the pane when the constraints are not specified. In particular, if `nil` is used in the ratios then the associated pane(s) will be fixed at their minimum size.

### Example

```lisp
(capi:display (make-instance 'capi:interface
   :title "Test"
   :visible-min-width 300))

(capi:display (make-instance 'capi:interface
   :title "Test"
   :visible-min-width 300
   :visible-max-height 200))
```

Here is a simple example that demonstrates the use of the `element-parent` accessor to place elements.
(setq pinboard (capi:contain
  (make-instance
   'capi:pinboard-layout
   :visible-min-width 520
   :visible-min-height 395))
(setq object
  (make-instance
   'capi:image-pinboard-object
   :x 10 :y 10
   :image
   (example-file "capi/graphics/Setup.bmp")
   :parent pinboard))

(capi:apply-in-pane-process
  pinboard #'(setf capi:element-parent) nil object)

(capi:apply-in-pane-process
  pinboard #'(setf capi:element-parent) pinboard object)

These final two examples illustrate the effect of initial-constraints.

Create a pane that starts at least 600 pixels high, but can be made shorter by the user:

(capi:contain
  (make-instance 'capi:output-pane
    :initial-constraints '(:visible-min-height 600)))

Compare with this, which creates a pane at least 600 pixels high but which cannot be made shorter.

(capi:contain
  (make-instance 'capi:output-pane
    :visible-min-height 600))

See also

set-hint-table
"Focus" on page 14
"Hierarchy of panes" on page 27
"Tooltips" on page 35
"Matching resources for GTK+" on page 269
Chapter 6, "Laying Out CAPI Panes"
element-container

Function

Summary
Returns the container of an element.

Package
capi

Signature
element-container element => container

Arguments
element An element.

Values
container A screen or a document-frame.

Description
The function element-container returns the container of the element element.

If element is inside a standalone interface, then container is the screen object.

If element is inside an interface that is inside a MDI interface, then container is the capi:container object of that MDI interface. See document-frame for details.

See also
document-frame
element
"Hierarchy of panes" on page 27

element-interface-for-callback

Generic Function

Summary
Returns the interface that is used in an element’s callbacks.

Package
capi

Signature
element-interface-for-callback element => interface
Description
The function `element-interface-for-callback` returns the interface that is passed to callbacks in `element`. Normally this is the interface that `element` is in, but that can be changed by `attach-interface-for-callback`.

See also
`attach-interface-for-callback`
`element`
“Callbars” on page 19

**element-screen**

Function

Summary
Returns the screen that an element is associated with.

Package
`capi`

Signature
`element-screen element => screen`

Description
The function `element-screen` returns the screen that the `element` is associated with.

See also
`element`
“Hierarchy of panes” on page 27
“Screens” on page 36

**ellipse**

Class

Summary
A pinboard object that draws itself as an ellipse.

Package
`capi`

Superclasses
`pinboard-object`

Accessors
`filled`

Initargs
`:filled` A boolean.
Description

The class ellipse is a pinboard-object that draws itself as an ellipse.

If filled is true, then the ellipse is filled with the foreground color. filled defaults to nil.

See also

“Creating graphical objects” on page 187

describe

ensure-area-visible

Generic Function

Summary

Ensures an area is visible in a scrollable pane.

Package
capi

Signature

ensure-area-visible self x y width height

Arguments

self A simple-pane with internal scrolling.

x,y The coordinates of the origin of the area to make visible.

width, height The dimensions of the area to make visible

Description

The generic function ensure-area-visible ensures that the area specified by x, y, width and height, or at least part of it, is visible.

This function works only for subclasses of simple-pane that do internal scrolling (such as editor-pane). An error is signalled if it is called with other classes.

describe

ensure-interface-screen

Function

Summary

Ensures that a top level interface is displayed on a given screen.

Package
capi
Signature  ensure-interface-screen  self  &key  screen

Description  The function ensure-interface-screen ensures that the top level interface is displayed on the given screen (or the default) if display is called later without a screen argument. This allows the querying of font and color information associated with a particular screen. It returns the screen that is used.

See also  screen  display  interface

execute-with-interface  

Function

Summary  Allows functions to be executed in the event process of a given interface.

Package  capi

Signature  execute-with-interface  interface  function  &rest  args

Arguments  interface  An interface  
function  A function designator  
args  Arguments passed to function  

Description  The function execute-with-interface is a useful way of operating on an interface owned by another process. It takes a top-level interface, a function and some arguments and queues the function to be run by that process when it next enters its event loop (for an interface owned by the current process, it calls the function immediately).
Notes

1. **execute-with-interface** applies *function* even if *interface* does not have a screen representation, for example when it is destroyed. To call *function* only if *interface* has a representation, use **execute-with-interface-if-alive**.

2. All accesses (reads as well as writes) on a CAPI interface and its sub-elements should be performed in the interface process. Within a callback on the interface this happens automatically, but **execute-with-interface** is a useful utility in other circumstances.

3. **execute-with-interface** calls *function* on the current process if *interface* does not have a process.

4. **apply-in-pane-process** and **apply-in-pane-process-if-alive** are other ways to call a function in the appropriate CAPI process. They takes panes of all classes, not merely *interface*.

Example

```lisp
(setq a (capi:display (make-instance 'capi:interface)))
(capi:execute-with-interface
 a 'break
 "Break inside the interface process")
(exexample-edit-file "capi/elements/progress-bar-from-background-thread")
```

See also

- **apply-in-pane-process**
- **apply-in-pane-process-if-alive**
- **execute-with-interface-if-alive**

“The correct thread for CAPI operations” on page 39
Chapter 7, “Programming with CAPI Windows”

**execute-with-interface-if-alive**

*Function*

**Summary**

Executes a function in the event process of a given interface if it is alive.
Package  
capi

Signature  
execute-with-interface-if-alive \textit{interface} \textit{function} \&rest \textit{args} => \textit{alivep}

Values  
\textit{alivep}  
A boolean.

Description  
The function \textit{execute-with-interface-if-alive} applies the function \textit{function} to the arguments \textit{args} in the process of the \textit{interface} \textit{interface}, if the interface is "alive". An interface become alive during the creation process before \textit{interface-display} is called (and before \textit{display} returns). It stops being alive once it is destroyed, either programmatically or by the user.

If \textit{interface} is not alive, \textit{function} is not applied. This is in contrast to \textit{execute-with-interface}, which in this case applies the function in the current process.

The return value \textit{alivep} is true if \textit{interface} was alive while \textit{execute-with-interface-if-alive} executed. It does not guarantee that \textit{function} is going to be called.

\textit{execute-with-interface-if-alive} is useful for automatic updating of interfaces that may be destroyed by the user, where the update is redundant if the interface is not alive.

Notes  
1. The return value is useful for checking whether the interface has gone away (for example closed by the user), in which case the caller may want to do something, most typically stop calling \textit{execute-with-interface-if-alive} on the dead interface. It should be checked only when the caller knows that the interface is already displayed (\textit{display} returned, or \textit{interface-display} was called on it), otherwise it may be \texttt{nil} because it is not displayed yet.
2. All accesses (reads as well as writes) on a CAPI interface 
and its sub-elements should be performed in the interface 
process. Using `execute-with-interface-if-alive` is 
one way of ensuring this.

See also
- `apply-in-pane-process-if-alive`
- `execute-with-interface`
- “The correct thread for CAPI operations” on page 39
- Chapter 7, “Programming with CAPI Windows”

### exit-confirm

**Function**

**Summary**
Called by the **OK** button on a dialog created with `popup-confirm`.

**Package**
capi

**Signature**
`exit-confirm &rest dummy-args`

**Description**
The function `exit-confirm` is called by the **OK** button on a 
dialog created using `popup-confirm`, and it is provided as an 
entry point so that other callbacks can behave in the same 
way. There is a full description of the **OK** button in `popup-confirm`.

**Example**
This example demonstrates the use of `exit-confirm` to 
make the dialog exit when pressing Return in the text input 
pane. It also demonstrates the use of `value-function` as a means 
of deciding the return value from `popup-confirm`.

```lisp
(capi:popup-confirm (make-instance 
  'capi:text-input-pane 
  :callback 'capi:exit-confirm) 
"Enter some text:"
:value-function 
'capi:text-input-pane-text)
```
exit-dialog

Function

See also popup- confirm er
display-dialog
interface
Chapter 11, “Dialogs: Prompting for Input”

exit-dialog

Summary
Exits the current dialog.

Package capi

Signature exit-dialog value

Description
The function exit-dialog is the means to successfully return a value from the current dialog. Hence, it might be called from an OK button so that pressing the button would cause the dialog to return successfully, while the Cancel button would call the counterpart function abort-dialog.

If there is no current dialog then exit-dialog does nothing and returns nil. If there is a current dialog then exit-dialog either returns non-nil or does a non-local exit. Therefore code that depends on exit-dialog returning must be written carefully - see the discussion under abort-dialog for details.

Example
(capi:display-dialog
 (capi:make-container
  (make-instance 'capi:text-input-pane
   ;callback-type :data
   ;callback 'capi:exit-dialog)
   ;title "Test Dialog"))

There is another example in:
(ex example-edit-file "capi/dialogs/simple-dialog")
See also  
abort-dialog
display-dialog
popup-confirmer
interface
Chapter 11, “Dialogs: Prompting for Input”

**expandable-item-pinboard-object**  
*Class*

**Summary**
A class used to implement nodes in `graph-pane`.

**Package**
capi

**Superclasses**
item-pinboard-object

**Description**
The class `expandable-item-pinboard-object` is a pinboard-object that `graph-pane` uses by default to implement nodes in a graph. `expandable-item-pinboard-object` draws itself with a small circle to indicate that the node has children.

See also `graph-pane`
“Creating graphical objects” on page 187

**extended-selection-tree-view**  
*Class*

**Summary**
A pane that displays a hierarchical list of items which (unlike `tree-view`) allows extended selection.

**Package**
capi

**Superclasses**
tree-view

**Description**
The class `extended-selection-tree-view` is like `tree-view` but allows more than one item to be selected at once.
Notes

1. Although `extended-selection-tree-view` is a subclass of `collection`, it does its own items handling and you must not access its `items` and related slots directly. In particular for `extended-selection-tree-view` do not pass `:items`, `:items-count-function`, `:items-get-function` or `:items-map-function`, and do not use the corresponding accessors.

2. The delete item callback (see `delete-item-callback` in `tree-view`) is called in `extended-selection-tree-view` with the second argument being a list of the selected items, unless `interaction` is `:single-selection`, in which case it behaves the same as in `tree-view`.

See also `tree-view` Chapter 5, “Choices - panes with items”

filtering-layout

Class

Summary A layout that can be used for filtering.

Package `capi`

Superclasses `row-layout`

Initargs `:callback-object`

The argument for the callbacks. If it is `nil` the top-level-interface of the layout is used.

`:change-callback`

A function of one argument (the `callback-object`). It is called whenever the text in the filter changes. Also if `callback` is not supplied, `change-callback` is called instead.
:callback A function of one argument (the callback-object). It is called when the user presses Return, makes a selection from the menu, or clicks the Confirm button. If callback is not supplied, change-callback is called instead.

:gesture-callbacks Additional gesture-callbacks to the text-input-pane inside the filtering-layout.

:text A string specifying the initial text of the filter, or nil.

:matches-title A string, t or nil.

:help-string A string, t or nil.

:label-style :short, :medium or :long.

Accessors filtering-layout-state
filtering-layout-matches-text

Description The main part of a filtering layout is a text-input-pane which allows the user to enter a string, which is intended to be used for filtering. The user can control how it is used by a menu (or special keystroke) that allows her to specify whether:

- The string is used as a regular expression or plain string (Control+R).
- The filter excludes matches or includes matches (Control+E).
- Filtering is case-sensitive or case-insensitive (Control+C).
The filtering layout defines the parameters to use, and calls the callbacks to perform the filtering. It does not do any filtering itself.

To actually do the filtering, the using code needs to call `filtering-layout-match-object-and-exclude-p`, which returns as multiple values a precompiled regexp and a flag specifying whether to exclude matches. The regexp should be used to perform the filtering, typically by using `lisp-works:find-regexp-in-string`. Note that `filtering-layout-match-object-and-exclude-p` returns `nil` when there is no string in the `text-input-pane`, and that even when the filter is set to plain match it returns a regexp (which matches a plain string).

You supply a `filtering-layout` amongst the `panes` of your interface definition (not its `layouts`). The description of a `filtering-layout` is set by the `initialize-instance` method of the class, and therefore the description cannot be passed as an initarg and should not be manipulated.

`filtering-layout-state` returns a "state" object which can be used later to set the state of any `filtering-layout` by `(setf capi:filtering-layout-state)`. When setting the state, the value can also be a string or `nil`. A string means setting the filter string to it and making the filtering state be plain string, includes matches, and case-insensitive. `nil` means the same as the empty string.

`matches-title` controls whether the `filtering-layout` contains a `display-pane` (the "matches pane") showing the number of matches. If `matches-title` is a string, it provides the title of the matches pane. If `matches-title` is `t` the title is `Matches`: Note that the actual text in the matches pane must be set by the caller by `(setf capi:filtering-layout-matches-text)`.

If `help-string` is non-nil then the filter has a Help button which raises a default help text if `help-string` is `t`, or the text of `help-string` if it is a string.
If *label-style* is :short the filter menu has a short title. For example if the filter is set for case-sensitive plain inclusive matching the short label is PMC. If *label-style* is :medium then this label would be Filter:C. Any other value of *label-style* would make a long label Plain Match Cased.

**Notes**

A filtering-layout is used when a list-panel is made with the :filter initarg.
Example

(defun *things* (list "Foo" "Bar" "Baz" 'car 'cdr))

(capi:define-interface my-interface ()
  ((things :reader my-things :initform *things*)
   (:panes
    (my-things-list-panel
capi:list-panel
    :reader my-interface-list-panel
    :items things
    :visible-min-height `(:character ,(length *things*))
    (my-filtering
capi:filtering-layout
    :change-callback 'update-my-interface
    :reader my-interface-filtering))
   (:layouts
    (a-layout
capi:column-layout '
    (my-filtering my-things-list-panel)))
   (:default-initargs :title "Filtering example")
  )
)

(defun update-my-interface (my-interface)
  (let* ((things (my-things my-interface))
    (filtered-things
     (multiple-value-bind (regexp excludep)
       (capi:filtering-layout-match-object-and-exclude-p
        (my-interface-filtering my-interface) nil)
       (if regexp
        (loop for thing in things
          when (if (find-regexp-in-string
            regexp
            (string thing))
            (not excludep)
            excludep)
          collect thing)
        things))
    )
  )

(setf (capi:collection-items
    (my-interface-list-panel my-interface))
    filtered-things))

See also filtering-layout-match-object-and-exclude-p
filtering-layout-match-object-and-exclude-p

Function

Summary
Returns filtering parameters for a filtering-layout.

Package
capi

Signature
filtering-layout-match-object-and-exclude-p filtering-layout display-message => regexp, excludep

Arguments
filtering-layout A filtering-layout.
display-message A generalized boolean.

Values
regexp A precompiled regular expression.
excludep A boolean.

Description
The function filtering-layout-match-object-and-exclude-p returns a regexp to use for filtering in the filtering-layout. The second returned value excludep specifies whether the filter should be used to exclude or include matches.

display-message is a generalized boolean controlling whether a message is displayed to the user if there is an error when compiling the regexp.

See filtering-layout for details.

See also filtering-layout

find-graph-edge

Generic Function

Summary
Finds and returns an edge in a graph given two items.

Package
capi

Signature
find-graph-edge graph from to => edge

Arguments
graph A graph-pane.
from An item in graph.
to An item in graph.

Description
The generic function find-graph-edge finds the edge that goes from the node corresponding to from to the node corresponding to to.
If there is no such edge, find-graph-edge returns nil.

See also
find-graph-node
graph-pane

find-graph-node  Generic Function

Summary
Finds and returns a node in a graph corresponding to an item.

Package
capi

Signature
find-graph-node graph object => node

Arguments
graph A graph-pane.
object An item in graph.

Values
node A node of graph, or nil.

Description
The generic function find-graph-node finds the node that corresponds to the item object.
If there is no such node, find-graph-node returns nil.

See also
find-graph-edge
graph-pane
find-interface  

**Generic Function**

**Summary**  Displays an interface of a given class, making it if necessary.

**Package**  capi

**Signature**  

\[
\text{find-interface class-name \&rest initargs \&key screen \&allow-other-keys => interface}
\]

**Arguments**  

- **class-name**: A specifier for a subclass of `interface`.
- **initargs**: Initialization arguments for `class-name`.
- **screen**: A `screen` or `nil`.

**Values**  

- `interface`: An interface of class `class-name`.

**Description**  
The generic function `find-interface` finds and displays an interface of the given class `class-name` that matches `initargs` and `screen`.

`class-name` can be the name of a suitable class, the class itself, or an instance of the class.

`screen` can be a CAPI object as accepted by `convert-to-screen`. `screen` defaults to the default screen.

`find-interface` calls `locate-interface` to locate an existing interface:

1. If an interface of the class specified by `class-name` matching `initargs` exists already on `screen`, then this interface is activated and returned.

2. Otherwise, if an interface of the class specified by `class-name` exists already on `screen`, then `reinitialize-interface` is applied to this interface which is then activated and returned.

If no instance of class `class-name` exists on `screen`, then `find-interface` creates one by passing `class-name` and `initargs` to `make-instance`, and displays the result on `screen`. 
There are many uses of `find-interface` in the LispWorks IDE.

See also
- `locate-interface`
- `reinitialize-interface`

**find-string-in-collection**

*Generic Function*

**Summary**
Returns the next item whose printed representation matches a given string.

**Package**
capi

**Signature**
`find-string-in-collection self string &optional set`

**Description**
The generic function `find-string-in-collection` returns the next item whose printed representation matches `string`. If `set` is non-nil, the choice selection is set to this item. The search is started from the previous search point. If the choice selection is set, the next search will start from the first selected item.

See also
- `collection`
- `collection-find-string`
- `collection-find-next-string`
- `collection-last-search`

**force-screen-update**

*Function*

**Summary**
Ensures a screen is up to date.

**Package**
capi

**Signature**
`force-screen-update &key screen`
The function `force-screen-update` makes sure that the screen specified by `screen` is up to date. `screen` can be a CAPI object as accepted by `convert-to-screen`. The default value of `screen` is `nil`.

On GTK+, `force-screen-update` does not work when it is called inside the `display-callback` of an `output-pane` or a subclass, including drawing of `pinboard-objects` inside a `pinboard-layout`.

```lisp
(example-edit-file "capi/graphics/plot-directly")
```

See also `force-update-all-screens`
The class `foreign-owned-interface` allows another application’s window to be the owner of a CAPI dialog. Instances should be created by calling `make-foreign-owned-interface`.

`foreign-owned-interface` is implemented only on Microsoft Windows.

### form-layout

**Class**

**Summary**  The class `form-layout` lays its children out in a form.

**Package**  `capi`

**Superclasses**  `layout`

**Initargs**

- `:vertical-gap`  The gap between rows in the form.
- `:vertical-adjust`  The adjustment made to the rows.
- `:title-gap`  The gap between the two columns.
- `:title-adjust`  The adjustment made to the left column.

**Accessors**

- `form-vertical-gap`
- `form-vertical-adjust`
- `form-title-gap`
- `form-title-adjust`

**Description**  The form layout lays its children out in two columns, where the children in the left column (which are usually titles) are right adjusted while the children in the right column are left adjusted.
Compatibility note
This class has been superseded by `grid-layout`, and will probably be removed at some point in the future. The examples below demonstrate the use of grid layouts as an alternative to forms.

Example

```lisp
(setq children (list
  "Button:" (make-instance 'capi:push-button :text "Press Me")
  "Enter Text:" (make-instance 'capi:text-input-pane)
  "List:" (make-instance 'capi:list-panel :items '(1 2 3))))

```

See also
`grid-layout`

`layout`

---

**free-metafile**

*Function*

**Summary**
Frees a metafile.

**Package**
capi

**Signature**
`free-metafile metafile`

**Arguments**
`metafile` A metafile.

**Description**
The function `free-metafile` releases the window system storage used by the metafile.

`free-metafile` must be called when the metafile is no longer needed, to avoid memory leaks.
free-metafile is supported on GTK+ only where Cairo is supported (GTK+ 2.8 and later).

Notes

free-metafile is not implemented on X11/Motif.

Examples

(example-edit-file "capi/graphics/metafile")

See also

clipboard
draw-metafile
draw-metafile-to-image

free-sound

Function

Summary

Frees a loaded sound object on Microsoft Windows and Cocoa.

Package
capi

Signature

free-sound sound

Arguments

sound An array returned by load-sound.

Description

The function free-sound unloads (frees) the loaded sound object sound.

Notes

free-sound is not implemented on GTK+ and Motif.

See also

load-sound
read-sound-file
“Sound API” on page 264

get-collection-item

Generic Function

Summary

Returns the item at a specified position in a collection.
### get-collection-item

**Package**
capi

**Signature**
get-collection-item self index

**Description**
The generic function get-collection-item returns the item at position index from the collection self. It achieves this by calling the items-get-function of the collection. There is also a complementary function, search-for-item which finds the index for a given item in a collection.

**See also**
collection
search-for-item

---

### get-constraints

**Function**
Returns the external constraints for an element.

**Package**
capi

**Signature**
get-constraints element => min-width, min-height, max-width, max-height

**Arguments**

- **element**
  An instance of simple-pane (or one of its subclasses), or an instance of pinboard-object (or one of its subclasses).

**Values**

- **min-width, min-height**
  Integers specifying the minimum external dimensions of element.

- **max-width, max-height**
  Integers specifying the maximum external dimensions of element.

**Description**
The function get-constraints returns the external constraints for element as multiple values.
The values are the minimum width, the minimum height, the maximum width and the maximum height of the element including borders. A containing layout will use these values when laying out its children.

`get-constraints` calls the generic function `calculate-constraints` to calculate these sizes initially, but then just uses the values in the geometry cache for the element. To force an element to take account of its new constraints, call the function `invalidate-pane-constraints`.

**See also**
- `calculate-constraints`
- `define-layout`  
- `element`
- `invalidate-pane-constraints`
- Chapter 6, “Laying Out CAPI Panes”

---

**get-horizontal-scroll-parameters**  
*Generic Function*

**Summary**
Queries the scroll parameters of a horizontal scroll bar.

**Package**
capi

**Signature**
`get-horizontal-scroll-parameters self &rest keys => parameter, parameter,...`

**Arguments**
- `self` A displayed `simple-pane`.
- `keys` Keywords as below.

**Values**
- `parameter` The parameters are returned as multiple values, one for each key passed in `keys` and in the same order as the arguments.
Description
Retrieves the specified parameters of the horizontal scroll bar of \textit{self}, which should be a displayed instance of a subclass of \texttt{simple-pane} which does internal scrolling (such as \texttt{editor-pane}).

The valid \texttt{keys} are:

\begin{itemize}
\item \texttt{:min-range} \hspace{1cm} The minimum data coordinate.
\item \texttt{:max-range} \hspace{1cm} The maximum data coordinate.
\item \texttt{:slug-position} \hspace{1cm} The current scroll position.
\item \texttt{:slug-size} \hspace{1cm} The length of the scroll bar slug.
\item \texttt{:page-size} \hspace{1cm} The scroll page size.
\item \texttt{:step-size} \hspace{1cm} The scroll step size.
\end{itemize}

Notes
For the other pane classes, such as \texttt{list-panel}, the underlying widget determines what the scroll range and units are.

Example
See the following CAPI example files:
\begin{itemize}
\item \texttt{output-panes/scroll-test.lisp}
\item \texttt{output-panes/scrolling-without-bar.lisp}
\end{itemize}

See also
\begin{itemize}
\item \texttt{get-scroll-position}
\item \texttt{get-vertical-scroll-parameters}
\item \texttt{scroll}
\item \texttt{set-horizontal-scroll-parameters}
\item \texttt{simple-pane}
\end{itemize}
“output-pane scrolling” on page 199

\textbf{get-page-area}

\textbf{Function}

Summary
Calculates the dimensions of suitable rectangles for use with \texttt{with-page-transform}.

Package\hspace{1cm}capi
The function **get-page-area** is provided to simplify the calculation of suitable rectangles for use with **with-page-transform**. It calculates and returns the width and height of the rectangle in the user’s coordinate space that corresponds to one printable page, based on the logical resolution of the user’s coordinate space in dpi.

For example, if a logical resolution of 72 dpi was specified, this means that each unit in user space would map onto 1/72 of an inch on the printed page, assuming that no **scale** is specified.

If **dpi** is **nil** or unspecified, the logical resolution of the specified screen is used, or the logical resolution of the default screen if no screen is specified. The **dpi** argument can be a number, or a list of two elements representing the logical resolution of the coordinate spaces in the x and y directions respectively.

If **scale** is specified the rectangle is calculated so that the image is scaled by this factor when printed. It defaults to 1.0.

**Examples**

(\example-edit-file "capi/printing/fit-to-page")
(\example-edit-file "capi/printing/multi-page")
(\example-edit-file "capi/printing/page-on-demand")

**See also**

printer-metrics
with-page-transform
“Printing from the CAPI—the Hardcopy API” on page 249

---

**get-printer-metrics**

*Function*

**Summary**

Returns the metrics for a printer.

**Package**

capi
get-printer-metrics

**Signature**

get-printer-metrics printer

**Description**

The function **get-printer-metrics** takes a printer as its argument and returns a printer-metrics object. The metrics values in this object should be accessed by the printer-metrics readers.

**See also**

set-printer-metrics
printer-metrics
with-page-transform
“Printing from the CAPI—the Hardcopy API” on page 249

---

**get-scroll-position**

**Generic Function**

**Summary**

Returns the current scroll position of a pane such as list-panel, display-pane or tree-view.

**Package**

capi

**Signature**

get-scroll-position pane dimension => position

**Arguments**

pane A pane with built-in scrolling.

dimension A keyword, either :horizontal or :vertical.

**Values**

position An integer or nil.

**Description**

The generic function get-scroll-position returns the scroll position of the pane pane in the given dimension.

pane should be an instance of a pane class that has built-in scrolling. That is, the scrolling is implemented by the underlying widget. Examples include list-panel, display-pane and tree-view.
In general, the units in the returned value position are unspecified, but they can be passed to the generic function scroll with operation :move to restore the position.

For a list-panel, the vertical units are items.

position is nil if pane is not displayed on the screen, for example if get-scroll-position is called after pane is destroyed.

See also
get-horizontal-scroll-parameters
get-vertical-scroll-parameters
scroll

generic_function
get-vertical-scroll-parameters

Summary
Queries the scroll parameters of a vertical scroll bar.

Package
capi

Signature
get-vertical-scroll-parameters self &rest keys => parameter, parameter,...

Arguments
self
A displayed output-pane or layout.

keys
Keywords as below.

Values
parameter
The parameters are returned as multiple values, one for each key passed in keys and in the same order as the arguments.

Description
The function get-vertical-scroll-parameters retrieves the specified parameters of the vertical scroll bar of self, which should be a displayed instance of a subclass of output-pane (such as editor-pane) or layout.

The valid keys are:

:min-range
The minimum data coordinate.

:max-range
The maximum data coordinate.
:slug-position
   The current scroll position.
:slug-size    The length of the scroll bar slug.
:page-size    The scroll page size.
:step-size    The scroll step size.

Notes
For the other pane classes, such as list-panel, the underlying widget determines what the scroll range and units are.

Example
(example-edit-file "capi/output-panes/scroll-test")
(example-edit-file "capi/output-panes/scrolling-without-bar")
(example-edit-file "capi/output-panes/pane-can-scroll")

See also
get-scroll-position
scroll
get-horizontal-scroll-parameters
set-vertical-scroll-parameters
simple-pane
"output-pane scrolling" on page 199

---

**graph-edge**

**Class**

**Summary**
The class of objects that represent edges in a graph.

**Package**
capi

**Superclasses**
graph-object

**Initargs**
:from    The node where the edge starts.
:to      The node where the edge ends.

**Accessors**
graph-edge-from
graph-edge-to
Description: The class of objects that represent edges in a graph-pane. *from* and *to* are the nodes that the edge connects.

See also: graph-pane

---

**graph-node**

**Class**

**Summary**: The class of objects that represent nodes in a graph.

**Package**: capi

**Superclasses**: graph-object

**Readers**: graph-node-x, graph-node-y, graph-node-width, graph-node-height, graph-node-in-edges, graph-node-out-edges

**Description**: The default class of nodes in a graph-pane. The graph-pane generates a graph of graph-node and graph-edge objects.

See also: graph-edge, graph-pane

---

**graph-node-children**

**Generic Function**

**Summary**: Returns the children of a graph node.

**Package**: capi

**Signature**: graph-node-children node => result
Arguments  

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>node</td>
<td>A graph-node.</td>
</tr>
</tbody>
</table>

Values  

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>result</td>
<td>A list.</td>
</tr>
</tbody>
</table>

Description  
The generic function `graph-node-children` returns a list of all the ‘children’ of the node `node`. These children are the nodes which are at the other end of some edge in the `graph-node-out-edges` of the `graph-node node`.

See also  

`graph-node`

---

**graph-object**  

**Class**

Summary  
The superclass of node and edge objects.

Package  
capi

Subclasses  

graph-edge

<table>
<thead>
<tr>
<th>Subclass</th>
</tr>
</thead>
<tbody>
<tr>
<td>graph-node</td>
</tr>
</tbody>
</table>

Readers  

graph-object-element

<table>
<thead>
<tr>
<th>Reader</th>
</tr>
</thead>
<tbody>
<tr>
<td>graph-object-object</td>
</tr>
</tbody>
</table>

Description  
The class `graph-object` is the superclass of `graph-edge` and `graph-node`.

The reader `graph-object-element` returns the CAPI object that is displayed.

The reader `graph-object-object` returns the user object associated with the graph object.

---

**graph-pane**  

**Class**

Summary  
A graph pane is a pane that displays a hierarchy of items in a graph.
Package: capi

Superclasses:
- simple-pinboard-layout
- choice

Subclasses: simple-network-pane

Initargs:
- :roots The roots of the graph.
- :children-function
  Returns the children of a node.
- :layout-function
  A keyword denoting how to layout the nodes.
- :layout-x-adjust
  The adjust value for the x direction.
- :layout-y-adjust
  The adjust value for the y direction.
- :node-pinboard-class
  The class of pane to represent nodes.
- :edge-pinboard-class
  The class of pane to represent edges.
- :node-pane-function
  A function to return a pane for each node.

Accessors:
- graph-pane-layout-function
- graph-pane-roots
A graph pane calculates the items of the graph by calling the children-function on each of its roots, and then calling it again on each of the children recursively until no more children are found. The children-function gets called with an item of the graph and should return a list of the children of that item.

Each item is represented by a node in the graph.

The layout-function tells the graph pane how to lay out its nodes. It can be one these values:

- **left-right**: Lay the graph out from the left to the right.
- **top-down**: Lay the graph out from the top down.
- **right-left**: Lay the graph out from the right to the left.
- **bottom-up**: Lay the graph out from the bottom up.

layout-x-adjust and layout-y-adjust act on the underlying layout to decide where to place the nodes. The values should be a keyword or a list of the form (keyword n) where n is an integer. These values of adjust are interpreted as by pane-adjusted-position. :top is the default for layout-y-adjust and :left is the default for layout-x-adjust.

When a graph pane wants to display nodes and edges, it creates instances of node-pinboard-class and edge-pinboard-class which default to item-pinboard-object and line-pinboard-object respectively. These classes must be subclasses of simple-pane or pinboard-object, and there are some examples of the use of these keywords below.

The node-pane-function is called to create a pane for each node, and by default it creates an instance of node-pinboard-class. It gets passed the graph pane and the item corresponding to the node, and should return an instance of a subclass of simple-pane or pinboard-object. If you use your own class which has its own geometry requirements, you should define a calculate-constraints method for it, which should use with-geometry on the object to set %min-width% and %height% to the desired width, and %height% and
%min-height% to the desired height. See the example in:

(example-edit-file "capi/graphics/circled-graph-nodes")

To expand or contract a node, the user clicks on the circle next to the node. An expandable node has an unfilled circle and a collapsible node has a filled circle.

graph-pane is a subclass of choice, so for details of its selection handling, see choice.

The highlighting of the children is controlled as described for pinboard-layout, but for graph-pane the default value of highlight-style is :standard.

Notes

The output-pane initarg :drawing-mode controls quality of drawing in a graph-pane, including anti-aliasing of any text displayed on Microsoft Windows and GTK+.

Compatibility

In LispWorks 4.3 the double click gesture on a graph-pane node always calls the action-callback, and the user gesture to expand or collapse a node is to click on the circle drawn alongside the node.

In LispWorks 4.2 and previous versions, the double click gesture was used for expansion and contraction of nodes and the action-callback was not always called.

Example

(defun node-children (node)
  (when (< node 16)
    (list (* node 2)
      (1+ (* node 2))))
      
(setq graph
  (capi:contain
   (make-instance 'capi:graph-pane
     :roots '(1)
     :children-function
     'node-children)
     :best-width 300 :best-height 400))

(capi:apply-in-pane-process
  graph #'(setf capi:graph-pane-roots) '(2 6) graph)
(capi:contain
  (make-instance 'capi:graph-pane
    :roots '(1)
    :children-function 'node-children
    :layout-function :top-down)
  :best-width 300 :best-height 400)

This example demonstrates a different style of graph output with right-angle edges and parent nodes being adjusted towards the top instead of at the center.

(capi:contain
  (make-instance 'capi:graph-pane
    :roots '(1)
    :children-function 'node-children
    :layout-function :top-down
    :layout-x-adjust :left)
  :best-width 300 :best-height 400)

This example demonstrates the use of :node-pinboard-class to specify that the nodes are drawn as push buttons.

(capi:contain
  (make-instance
    'capi:graph-pane
    :roots '(1)
    :children-function 'node-children
    :edge-pinboard-class 'capi:right-angle-line-pinboard-object)
  :best-width 300
  :best-height 400)

There are more examples here:
(example-edit-file "capi/graphics/*graph*")

See also
find-graph-edge
find-graph-node
graph-edge
graph-node
graph-node-children
graph-pane-add-graph-node
graph-pane-delete-object
graph-pane-delete-objects
graph-pane-delete-selected-objects
graph-pane-direction
graph-pane-edges
graph-pane-nodes
graph-pane-object-at-position
graph-pane-select-graph-nodes
graph-pane-update-moving-objects
*maximum-moving-objects-to-track-edges*
output-pane
“CAPI elements” on page 2
Chapter 5, “Choices - panes with items”
Chapter 12, “Creating Panes with Your Own Drawing and Input”

**graph-pane-add-graph-node**

*Generic Function*

**Summary**

Adds a node to a graph.

**Package**

capi

**Signature**

```lisp
graph-pane-add-graph-node graph-pane object parent-node => new-node
```

**Arguments**

- `graph-pane`: A graph-pane.
- `object`: An object.
- `parent-node`: A graph-node.
Values

new-node
A graph-node.

Description

The generic function graph-pane-add-graph-node adds a new node in the graph graph-pane corresponding to object, and links it as a child of parent-node.

See also

graph-node
graph-pane

---

**graph-pane-delete-object**

*Generic Function*

Summary

Removes a node from a graph.

Package
capi

Signature
graph-pane-delete-object graph-pane object

Arguments

graph-pane
A graph-pane.

object
An object.

Description

The generic function graph-pane-delete-object deletes the node corresponding to object in the graph graph-pane.

See also

graph-node
graph-pane
graph-pane-add-graph-node
graph-pane-delete-objects

---

**graph-pane-delete-objects**

*Generic Function*

Summary

Removes nodes from a graph.

Package
capi

Signature
graph-pane-delete-objects graph-pane objects
Arguments

- **graph-pane**: A graph-pane.
- **objects**: A list of objects.

Description

The generic function `graph-pane-delete-objects` deletes the node in the graph `graph-pane` corresponding to each object in the list `objects`.

See also

- `graph-node`
- `graph-pane`
- `graph-pane-delete-object`

---

**graph-pane-delete-selected-objects**

*Generic Function*

Summary

Removes selected nodes from a graph.

Package

capi

Signature

`graph-pane-delete-selected-objects graph-pane`

Arguments

- **graph-pane**: A graph-pane.

Description

The generic function `graph-pane-delete-selected-objects` deletes the currently selected nodes in the graph `graph-pane`.

See also

- `graph-node`
- `graph-pane`
- `graph-pane-delete-object`

---

**graph-pane-direction**

*Generic Function*

Summary

Returns or sets the direction of a graph.

Package

capi
Signature  \texttt{graph-pane-direction graph-pane => direction}  
\texttt{(setf graph-pane-direction) direction graph-pane => direction}

Arguments  \texttt{graph-pane} \quad A \texttt{graph-pane}.

Values  \texttt{direction} \quad One of \texttt{:forwards} or \texttt{:backwards}.

Description  The generic function \texttt{graph-pane-direction} returns the direction of the graph \texttt{graph-pane}. If the \texttt{layout-function} of \texttt{graph-pane} is \texttt{:top-down} or \texttt{:left-right} then \texttt{direction} is \texttt{:forwards}. Otherwise \texttt{direction} is \texttt{:backwards}.

The generic function (\texttt{setf graph-pane-direction}) maintains the dimension of the \texttt{layout-function} but potentially reverses its direction.

Example  
\begin{verbatim}
(setf gp
  (make-instance 'capi:graph-pane
    :layout-function :top-down))
=>
#<CAPI:GRAPH-PANE [0 items] 20603294>

(setf (capi:graph-pane-direction gp) :backwards)
=>
NIL

(capi:graph-pane-layout-function gp)
=>
:TOP-DOWN
\end{verbatim}

See also  \texttt{graph-pane}

\textbf{graph-pane-edges} \quad \textbf{Function}

Summary  Returns the edges of a graph.

Package  \texttt{capi}
Signature: \texttt{graph-pane-edges graph-pane => edges}

Arguments: \texttt{graph-pane} A \texttt{graph-pane}.

Values: \texttt{edges} A list.

Description: The function \texttt{graph-pane-edges} returns a list of all the \texttt{graph-edge} objects in the graph \texttt{graph-pane}.

See also: \texttt{graph-edge} \texttt{graph-pane}

\textbf{graph-pane-nodes} \hspace{10cm} \textit{Function}

Summary: Returns the nodes of a graph.

Package: \texttt{capi}

Signature: \texttt{graph-pane-nodes graph-pane => nodes}

Arguments: \texttt{graph-pane} A \texttt{graph-pane}.

Values: \texttt{nodes} A list.

Description: The function \texttt{graph-pane-nodes} returns a list of all the \texttt{graph-node} objects in the graph \texttt{graph-pane}.

See also: \texttt{graph-node} \texttt{graph-pane}

\textbf{graph-pane-object-at-position} \hspace{10cm} \textit{Function}

Summary: Returns the graph object at a given position in a graph.

Package: \texttt{capi}
**graph-pane-object-at-position**

**Signature**

\[ \text{graph-pane-object-at-position } \text{graph-pane } x \ y = \Rightarrow \text{object} \]

**Arguments**

- \text{graph-pane} \quad \text{A graph-pane.}

**Values**

- \text{object} \quad \text{A graph-object, or nil.}
- \text{x, y} \quad \text{Non-negative numbers.}

**Description**

The function \text{graph-pane-object-at-position} returns the \text{graph-object} (either a \text{graph-edge} or a \text{graph-node}) at the coordinates \(x, y\) in the graph \text{graph-pane}.

If there is no \text{graph-object} at position \(x,y\) then \text{graph-pane-object-at-position} returns \text{nil}.

**See also**

- \text{graph-pane}

---

**graph-pane-select-graph-nodes**

**Generic Function**

**Summary**

Selects nodes in a graph according to a predicate.

**Package**

capi

**Signature**

\[ \text{graph-pane-select-graph-nodes } \text{graph-pane } \text{predicate} \]

**Arguments**

- \text{graph-pane} \quad \text{A graph-pane.}
- \text{predicate} \quad \text{A function of one argument with boolean result.}

**Description**

The generic function \text{graph-pane-select-graph-nodes} applies \text{predicate} to all of the \text{graph-nodes} in \text{graph-pane}, and sets the \text{selected-items} to be the objects corresponding to those nodes for which \text{predicate} returns a true value.

**See also**

- \text{choice-selected-items}
- \text{graph-node}
- \text{graph-pane}
**graph-pane-update-moved-objects**  
*Generic Function*

**Summary**  
Updates a graph after the user moves objects.

**Package**  
capi

**Signature**  
`graph-pane-update-moved-objects graph-pane objects`

**Arguments**  
- `graph-pane`: A graph-pane.
- `objects`: A list.

**Description**  
The generic function `graph-pane-update-moved-objects` is called after some objects in the graph `graph-pane` were moved by a user gesture.

`objects` is a list containing the objects that were moved.

The primary method updates the geometry of edges connected to the moved objects. You can add non-primary methods to perform other operations at that point.

**See also**  
`graph-pane`

**grid-layout**  
*Class*

**Summary**  
A layout which positions its children on a two dimensional grid.

**Package**  
capi

**Superclasses**  
x-y-adjustable-layout

**Subclasses**  
row-layout  
column-layout

**Initargs**  
- `:columns`: The number of columns in the grid.
:has-title-column-p
   A boolean specifying whether the first column is a title column.

:orientation
   The orientation of the children.

:rows
   The number of rows in the grid.

:x-ratios
   The ratios between the columns.

:y-ratios
   The ratios between the rows.

:x-gap
   The gap between each column.

:y-gap
   The gap between each row.

:x-uniform-size-p
   If t, make each of the columns the same size.

:y-uniform-size-p
   If t, make each of the rows the same size.

:min-column-width
   nil, or a real number which provides a minimum of the width of each column.

:min-row-height
   nil, or a real number which provides a minimum of the height of each row.

Accessors
   layout-x-ratios
   layout-y-ratios
   layout-x-gap
   layout-y-gap

Description
   The row and column sizes are controlled by the constraints on their children. For example, the \textit{visible-min-width} of any column is the maximum of the \textit{visible-min-width} of any child in the column. The size of the layout is controlled by the constraints on the rows and columns.
For grid-layout description is either a two dimensional array or a list in the order specified by orientation (which defaults to :row). In the case of a list, one of columns or rows can be supplied to specify the dimensions (the default is two columns). As well as panes, slot names and strings, description may contain the element nil, which is interpreted as a special dummy pane with suitable geometry for resizable gaps. This special interpretation of nil in the description is specific to grid-layout and its subclasses.

The x-ratios and y-ratios slots control the sizes of the elements in a grid layout in the following manner:

The elements of x-ratios (or y-ratios) control the size of each child relative to the others. If an element in x-ratios (or y-ratios) is nil the child is fixed at its minimum size. Otherwise the size is calculated as follows

\[ \text{round} \left( \frac{\text{total \ ratio}}{\text{ratio-sum}} \right) \]

where ratio-sum is the sum of the non-nil elements of x-ratios (or y-ratios) and ratio is the element of ratios corresponding to the child. If this ideal ratio size does not fit the maximum or minimum constraints on the child size, and the constraint means that changing the ratio size would not assist the sum of the child sizes fitting the total space available, then the child is fixed at its constrained size, the child is removed from the ratio calculation, and the calculation is performed again.

If x-ratios (or y-ratios) has fewer elements than the number of children, 1 is used for each of the missing ratios. Leaving x-ratios (or y-ratios) nil causes all of the children to be the same size.

The positions of each pane in the layout can be specified using x-adjust and y-adjust like every other x-y-adjustable-layout, except that if there is one value then it is used for all of the panes, whereas if it is a list then each value in the list refers to one row or column. If the list does not contain a value for every row or column then the last value is taken to refer to all of the remaining panes.
Normally, the items in a grid-layout are arranged to look like a set of columns that are joined horizontally and rows that are joined vertically. All the cells in each column have the same width and all the cells in each row have the same height. The keyword :right-extend (or :bottom-extend) can be used to allow an item to span more than one column (or row). The keyword should be placed in the cell of the description that you want the item to expand into. For :right-extend, the cell immediately to the left will be extended to fill both columns in that row. For :bottom-extend, the cell immediately above will be extended to fill both rows in that column.

If has-title-column-p is true, then the items in the description which correspond to the first column are treated specially:

A string Equivalent to specifying (:title string)
A list of the form (:title string . options)
    Make a title using the given list as initargs. options is a plist of options, which can include the keys :title-font, :title-args, :mnemonic or :mnemonic-escape. See titled-object for how these are processed.
A list of the form (:mnemonic-title string . options)
    Make a title using the given list as initargs. string can contain the mnemonic escape. options is a plist of options, which can include the keys :title-font, :title-args, or :mnemonic-escape. See titled-object for how these are processed.

Notes Mnemonics are not supported on all platforms.
This example illustrates the special interpretation of \texttt{nil} in the \textit{description}:
(capi:contain
  (make-instance 'capi:grid-layout
    :description (cdr
      (loop for i below 5
        appending
        (list
          nil
          (make-instance 'capi:simple-pane
            :background :red
            :visible-min-width 50
            :visible-max-width t
            :visible-min-height 50
            :visible-max-height t))))
    :columns 3)
    :height 150 :width 150 :title "Resize Me")

This example illustrates the use of :right-extend and :bottom-extend to make cells span multiple columns and rows:

(example-edit-file "capi/layouts/extend")

There are more examples here:

(example-edit-file "capi/applications/")

This example is a grid with :has-title-column-p t:

(example-edit-file "capi/layouts/titles-in-grid")

See also layout
"CAPI elements" on page 2
"Controlling Mnemonics" on page 13
Chapter 6, “Laying Out CAPI Panes”

hide-interface

Function

Summary The function hide-interface hides the interface containing a specified pane.

Package capi
The function `hide-interface` hides the interface containing `pane` from the screen. If `iconify` is non-nil then it will iconify it, else it will just remove it from the screen. To show it again, use `show-interface`.

The default value of `iconify` is `t`.

See also `interface`  
`show-interface`  
`quit-interface`  
“Manipulating top-level windows” on page 105

---

**hide-pane**  
*Function*

**Summary**  
Hides the specified pane.

**Package**  
`capi`

**Signature**  
`hide-pane pane => pane`

**Arguments**  
`pane`  
An instance of `simple-pane` or a subclass.

**Description**  
The function `hide-pane` hides the pane `pane`, removing it from the screen. `pane`'s children, if any, are hidden too.

To restore `pane` to the screen, use `show-pane`.

See also  
`hide-interface`  
`show-pane`

---

**highlight-pinboard-object**  
*Function*

**Summary**  
Highlights a specified pinboard object.
Package | capi
---|---
Signature | highlight-pinboard-object pinboard object &key redisplay => was-unhighlighted-p
Arguments | pinboard | A pinboard-layout.
| object | A pinboard-object.
| redisplay | A generalized boolean.
Values | was-unhighlighted-p | A boolean.
Description | The function highlight-pinboard-object causes the pinboard object object to become highlighted until unhighlight-pinboard-object is called on it.
The pinboard object highlighting is drawn according to the highlight-style of the pinboard-layout pinboard.
If redisplay is non-nil the highlighting is drawn immediately.
The default value for redisplay is t.
The returned value was-unhighlighted-p is true if object was unhighlighted before the call.
See also | unhighlight-pinboard-object
draw-pinboard-object-highlighted
pinboard-object
pinboard-layout

image-list | Class
---|---
Summary | An object used to manage the images displayed by tree views and list views.
Package | capi
Superclasses  capi-object

Initargs  
: image-width  The width of the images in this image list.
: image-height The height of the images in this image list.
: image-sets  A list of images or image sets.

Description  The initarg :image-sets specifies a list. Each item in the list image-sets may be one of the following.

A pathname or string
   This specifies the filename of a file suitable for loading with load-image.

A symbol  The symbol must be a predefined image identifier, or have been registered by means of a call to register-image-translation.

An image object, as returned by load-image.

An image-set object
   See image-set for further details.

Note that image sets are added in their entirety; it is not possible to use image-locators to extract a single image from an image set.

The images added to the image list are numbered in order, starting from zero. An image-set containing n images contributes n images to the image list, and hence consumes n consecutive integer indices.

Example  
(example-edit-file "capi/choice/tree-view"
(example-edit-file "capi/choice/extended-selection-tree-view"

See also  image-set
load-image
register-image-translation
"image-list, image-set and image-locator" on page 64
image-locator

Summary: The type of the object that \texttt{make-image-locator} creates.

Package: \texttt{capi}

Description: The type \texttt{image-locator} is the type of the object that \texttt{make-image-locator} creates.

See also \texttt{make-image-locator}.

See also “image-list, image-set and image-locator” on page 64.

image-pinboard-object

Summary: An image pinboard object is a pinboard object that displays itself as an image.

Package: \texttt{capi}

Superclasses: \texttt{pinboard-object}, \texttt{titled-object}

Initargs: \texttt{:image} The image to be displayed.

Accessors: \texttt{image-pinboard-object-image}

Description: The \texttt{image} initarg for an \texttt{image-pinboard-object} should either be an \texttt{external-image} or any other object accepted by \texttt{load-image}. The image displayed in the object can be changed dynamically using the writer function

\begin{verbatim}
(setf image-pinboard-object-image)
\end{verbatim}
Example

(cd (example-file "capi/"))

(setf image
    (capi:contain
        (make-instance
            'capi:image-pinboard-object
            :image "applications/images/info.bmp")))

(capi:apply-in-pane-process
    (capi:element-parent image)
    #'(setf capi:image-pinboard-object-image
        "graphics/Setup.bmp" image)

(capi:apply-in-pane-process
    (capi:element-parent image)
    #'(setf capi:image-pinboard-object-image
        "applications/images/info.bmp" image)

(capi:contain
    (make-instance
        'capi:image-pinboard-object
        :image "graphics/Setup.bmp"
        :title "LispWorks Splashscreen"
        :title-adjust :right
        :title-position :bottom))

See also

pinboard-layout
"Creating graphical objects" on page 187
"Working with images" on page 219

image-set

Class

Package capi

Description An image set is an object that identifies the location of an image. The image is typically a large image to be broken down into sub-images. The sub-images must all have the same size and be positioned side by side.

The following functions are available to create image set objects:
install-postscript-printer  

Function

Summary
Installs or modifies a Postscript printer definition.

Package
capi

Signature
install-postscript-printer name &key if-exists default savep ppd-file description use-jcl command use-file always-print-to-file orientation installed-options

Arguments

name
A string.

if-exists
One of :supersede, :error or nil.

default
One of t, nil or :when-none.

savep
A boolean.

ppd-file
A string or pathname.

description
A string, or :preserve.

use-jcl
A boolean, or :preserve.

command
A string, or :preserve.

use-file
A boolean, or :preserve.

always-print-to-file
A boolean, or :preserve.

orientation
One of :landscape, :portrait or :preserve.
Installed-options: An association list, or :preserve.

Description: The function `install-postscript-printer` installs or modifies a Postscript printer definition for the given printer name.

This applies only on Motif.

`name` is a string naming the printer.

`if-exists` controls what happens if the named printer is already known. The default value is :supersede.

`default` controls whether the default printer is set. The value `t` forces the default printer to be set. The value `:when-none` causes the default printer to be set if there is currently no default. The default value of `default` is `nil`.

`savep`, if true, causes the printer to be saved for subsequent sessions, by writing a file to the path specified by the first item of *printer-search-path*.

`ppd-file`, if non-nil, should be a pathname or string specifying the name of a PPD file (PostScript Printer Description File) which comes with the printer and specifies the printer properties. `ppd-file` must be supplied when installing a new printer. The default value is `nil`.

All the other arguments provide optional printer information. Each defaults to the value :preserve, which means that appropriate defaults are used. These correspond to the settings on the dialog displayed by `printer-configuration-dialog`. Non-default values are as follows:

`description` is a string describing the printer.

`use-jcl` controls whether to use Job Control Language (JCL).

`command` is the command to execute to print with the printer.

`use-file` controls how to pass data to the printer. A true value means a file is used, `nil` means a pipe is used.
always-print-to-file controls whether printing always goes to a file.

orientation controls the orientation of the output.

installed-options is an association list, with pairs of strings where the car is an option name and the cdr is its value. Which options are available and their potential values is defined by the *OpenUI/*CloseUI and *JCLOpenUI/*JCLCloseUI entries in the PPD file.

See also printer-configuration-dialog
*ppd-directory*
*printer-search-path*
uninstall-postscript-printer
“Printing on Motif” on page 252

installed-libraries

Function

Summary
Returns the installed libraries.

Package
capi

Signature
installed-libraries => libraries

Values
libraries A list of library names.

Description
The function installed-libraries returns the list of installed CAPI libraries.

A library name is a keyword naming a library.

On Linux, FreeBSD, AIX and x86/x64 Solaris platforms, libraries is initially (:gtk) but may also include :motif if the deprecated "capi-motif" module is loaded.

On Microsoft Windows platforms, currently libraries is always (:win32).
On Mac OS X platforms, in the native GUI image libraries is always (:cocoa). In the Mac OS X/GTK+ image, libraries is initially (:gtk) but may also include :motif if the deprecated "capi-motif" module is loaded.

In LispWorks for SPARC Solaris libraries is always (:motif).

See also default-library
“CAPI communication with host window system - libraries” on page 272

**interactive-pane**

*Class*

**Summary**

An interactive-pane is an editor with a process reading and processing input, and that collects any output into itself. We are considering deprecating interactive-pane - please contact Lisp Support if you use it.

**Package**
capi

**Superclasses**
editor-pane

**Subclasses**
listener-pane
shell-pane

**Initargs**

:top-level-function

The input processing function.

**Readers**

interactive-pane-stream
interactive-pane-top-level-function

**Description**

An interactive-pane contains its own GUI stream. The top-level-function is called once, when the interactive pane is created: it needs to repeatedly take input from the GUI stream and write output to it. The top-level-function is called on a separate process from the process that displays the pane and does editor interaction. If the top-level-function wants to
invoke CAPI functionality, it needs to use `apply-in-pane-process` to ensure it is done on the right process. If the `top-level-function` returns, the process just exits, but the pane itself stays and continues to function as an `editor-pane`.

Note that because the pane is a fully functional `editor-pane`, the user can perform complex operations, and the `top-level-function` should try to cope with it. For example, the user may yank a very large amount of text, or may delete half of the buffer.

The first argument to `top-level-function` is the interface containing the interactive pane. The second argument is the interactive pane itself. The third argument is the GUI stream. The default for `top-level-function` is a function which runs a Lisp listener top-loop.

**Notes**

The class `listener-pane` is built upon `interactive-pane`. `listener-pane` adds functionality for handling Lisp forms and handles complexities involved with the interaction with the Editor, so it is much easier to use. If you use `interactive-pane` directly please contact Lisp Support.

**Compatibility note**

This class was named `interactive-stream` in LispWorks 3.2 but has been renamed to avoid confusion (as this class is not a stream but a pane that contains a stream). `interactive-stream` and its accessors `interactive-stream-top-level-function` and `interactive-stream-stream` have now been removed.

**Example**

This example assumes there is just one line of output from each command sent to the pipe.
See also collector-pane
“Stream panes” on page 30

interactive-pane-execute-command

Generic Function

Summary
Simulates user entry of commands in an interactive-pane.

Package
capi

Signature
interactive-pane-execute-command command
&key command-modification-function editp &allow-other-keys

Arguments
interactive-pane An interactive-pane.
command A Lisp form.
command-modification-function

A function or nil.

editp

A generalized boolean.

Description

The generic function `interactive-pane-execute-command` has the same effect as the user typing the Lisp form `command` into the `interactive-pane` and pressing `Return`.

`interactive-pane-execute-command` may be called from any process.

If `command-modification-function` is non-nil, it is a function of one argument. It is called with argument `command` in the process in which `interactive-pane` runs. The result of this call is used as the command to enter. The default value of `command-modification-function` is nil.

If `editp` is true then the command is left at the end of the pane for the user to edit before pressing `Return`. If `editp` is nil then `interactive-pane-execute-command` simulates the user pressing `Return`. The default value of `editp` is nil.

See also

`interactive-pane`

`listener-pane-insert-value`

interface

Class

Summary

The class `interface` is the top level window class, which contains both menus and a hierarchy of panes and layouts. Interfaces can also themselves be contained within a layout, in which case they appear without their menu bar.

Package

capi

Superclasses

`simple-pane`

`titled-object`
:title A string, the title of the interface.

:layout The layout of the interface.

:menu-bar-items The items on the menu bar.

:auto-menus A flag controlling the automatic addition of menu objects.

:create-callback A callback done on creating the window, before display and user interaction.

:destroy-callback A callback done on closing the window.

:confirm-destroy-function A function to verify closing of the window.

:best-x The best x position for the interface.

:best-y The best y position for the interface.

:best-width The best width of the interface.

:best-height The best height of the interface.

:geometry-change-callback A function called when the interface geometry changes.

:activate-callback A function called when the interface is activated or deactivated.

:iconify-callback A function called when the interface is iconified or restored.
:override-cursor
A cursor that takes precedence over the cursors of panes inside the interface.
override-cursor is not supported on Cocoa.
override-cursor is ignored by text-input-pane on GTK+.

:message-area
A boolean determining whether the interface has a message area.

:enable-pointer-documentation
A boolean determining whether Pointer Documentation is enabled.
enable-pointer-documentation is supported only on Motif. It is possible to implement equivalent functionality for output-pane and subclasses such as pinboard-layout by using the focus-callback of output-pane.

:enable-tooltip
A boolean determining whether Tooltip Help is enabled.

:help-callback
A function called when a user gesture requests help.

:top-level-hook
A function called around the top level event handler.

:external-border
An integer or nil.

:initial-focus
A pane, a symbol naming a pane, or nil.

:display-state
One of the keywords :normal, :maximized, :iconic and :hidden.
:transparency
A real number in the inclusive range [0,1], used on Cocoa, later versions of Microsoft Windows, and GTK+.

>window-styles
A list of keywords, or nil.

:toolbar-items
A list of items for the toolbar.

:toolbar-states
A toolbar state plist.

(default-toolbar-states)
A toolbar state plist.

:pathname
A pathname designator.

:drag-image
nil, t or an image specifier (that is, a value acceptable as the id argument of load-image).
Accessors

interface-title
pane-layout
interface-menu-bar-items
interface-create-callback
interface-destroy-callback
interface-confirm-destroy-function
interface-geometry-change-callback
interface-activate-callback
interface-iconify-callback
interface-override-cursor
interface-message-area
interface-pointer-documentation-enabled
interface-tooltip-enabled
interface-help-callback
top-level-interface-external-border
top-level-interface-transparency
interface-toolbar-items
interface-toolbar-states
interface-default-toolbar-states
interface-pathname
interface-drag-image

Readers

interface-window-styles

Description

Every interface can have a title title which when it is a top level interface is shown as a title on its window, and when it is contained within another layout is displayed as a decoration (see the class titled-object for more details).

The argument layout specifies a layout object that contains the children of the interface. To change this layout you can either use the writer pane-layout, or you can use the layout switchable-layout which allows you to easily switch the currently visible child.

The argument menu-bar-items specifies a list of menus to appear on the interface’s menu bar.

auto-menus defaults to t, which means that an interface may have some automatic menus created by the environment in which it is running (for example the Works menu in the Lisp-Works IDE). To switch off these automatic menus, pass :auto-menus nil.
Note: On Cocoa, certain system menu commands such as Edit > Start Dictation are added automatically. auto-menus does not control this.

When you have an instance of an interface, you can display it either as an ordinary window or as a dialog using respectively display and display-dialog. The CAPI calls create-callback (if supplied) with the interface as its single argument, after all the widgets have been created but before the interface appears on screen. Then to remove the interface from the display, you use quit-interface and either exit-dialog or abort-dialog respectively. When the interface is about to be closed, the CAPI calls the confirm-destroy-function (if there is one) with the interface, and if this function returns non-nil the interface is closed as if by calling destroy. Once the interface is closed, the destroy-callback is called with the interface. Therefore, neither confirm-destroy-function nor destroy-callback should call destroy.

Note: create-callback should be used only for operations that must be done with the interface already created and cannot be done in interface-display. Otherwise they should be either done in initialize-instance or between your calls to make-instance and display. An operation that needs to run after the interface is created but just before displaying the interface as an ordinary window (typical cases are font queries and loading images) can be put in the interface-display :before method. An operation that needs to run just after displaying the interface as an ordinary window can be put in the interface-display :after method.

The interface also accepts a number of hints as to the size and position of the interface for when it is first displayed. The arguments best-x and best-y must be the position as an integer or nil (meaning anywhere), while the arguments best-width and best-height can be any hints accepted by :visible-max-width and :visible-max-height for elements.
Whether or not an interface window is resizable is indicated as allowed by the window system. For non-resizable windows on Cocoa the interface window’s maximize button is disabled and the resize indicator is not shown, and on Microsoft Windows the maximize box is disabled.

`geometry-change-callback` may be `nil`, meaning there is no callback. This is the default value. Otherwise `geometry-change-callback` is a function of five arguments: the interface and the geometry. Its signature is:

```
geometry-change-callback interface x y width height
```

`x` and `y` are measured from the top-left of the screen rectangle representing the area of the primary monitor (the primary screen rectangle).

`activate-callback` may be `nil`, meaning there is no callback. This is the default value. Otherwise `activate-callback` is a function of two arguments: the interface and a boolean `activatep` which is true on activation and false on deactivation. Its signature is:

```
activate-callback interface activatep
```

`iconify-callback` may be `nil`, meaning there is no callback. This is the default value. Otherwise `iconify-callback` is a function of two arguments: the interface and a boolean `iconify` which is true when `interface` is iconified and false when it is restored. Its signature is:

```
iconify-callback interface iconifyp
```

`override-cursor`, if non-nil, specifies a cursor that is used instead of the cursor of each pane inside the interface. The default value of `override-cursor` is `nil`. See below for an example of setting and unsetting the override cursor. `override-cursor` is not supported on Cocoa. `override-cursor` is ignored by `text-input-pane` on GTK+.
If message-area is true, then the interface is created with a message area at the bottom. The text of the message area can be accessed using the titled-object accessor titled-object-message. The default value of message-area is nil.

enable-pointer-documentation is a boolean controlling whether Pointer Documentation is enabled, on Motif. The default value is t. The actual action is done by the help-callback.

enable-tooltips is a boolean controlling whether Tooltip Help is enabled. The default value is t. The actual action is done by the help-callback.

help-callback may be nil, meaning there is no callback. This is the default value. Otherwise help-callback is a function of four arguments: the interface, the pane inside interface where help is requested, the type of help requested, and the help key of the pane. Its signature is:

help-callback interface pane type help-key

Here type can be one of:

:tooltip A tooltip is requested. The function needs to return a string to display in the tooltip, or nil if no tooltip should be displayed.

:help The function should display a detailed, asynchronous help. This value is passed when the user presses the F1 key (not implemented on Cocoa). :help is also passed when the user clicks the ‘?’ box in the title bar of a Microsoft Windows dialog with window style :contexthelp (see window-styles below).

On Motif only, type can also be one of:

:pointer-documentation-enter

The cursor entered the pane. The function should set the pointer documentation.
:pointer-documentation-leave

The cursor left the pane. The function needs to reset the pointer documentation.

/help-key is the help-key of pane, as described in element. There is an example illustrating help-callback in:

(example-edit-file "capi/elements/help")

and there is another example below.

top-level-hook can be used on Microsoft Windows and Motif to specify a hook function that is called around the interface’s top level event handler. The hook is passed two arguments: a continuation function (with no arguments) and the interface. The hook must call the continuation, which normally does not return. top-level-hook is designed especially for error handling (see below for an example). It can also be used for other purposes, for instance to bind special variables around the top level function. top-level-hook is not supported on Cocoa.

external-border controls how close to the edge of the screen the interface can be placed with explicit positioning using the best-x, best-y, best-height and best-width initargs or implicit positioning when a dialog is centered within its owner. The value nil allows the window to be anywhere, on or off the screen. The value 0 allows the window can be anywhere on the screen. If external-border is a positive integer then the window can be anywhere within external-border pixels from the edge of the screen. If external-border is a negative integer then the window be anywhere on the screen or up to external-border pixels off the edge of the screen. This does not affect whether the use can move the window after it has been displayed. It also does not affect the default positioning of interfaces, where the window system chooses the position. The default value of external-border is 0.
*initial-focus* specifies a pane which has the input focus when the interface is first displayed. See *pane-initial-focus* for more information about the initial focus pane.

*display-state* controls the initial display of the interface window, as described for *top-level-interface-display-state*.

*transparency* is the overall transparency of the whole interface, where 0 is fully transparent and 1 is fully opaque. This has no effect on whether the user can click on the window. This is implemented for Cocoa and Microsoft Windows. It also works on GTK+, provided that GTK+ and the X server support it. On GTK+ it is supported in version 2.12 and later. The X server needs compositing manager to do it. *transparency* should only be used for top-level interfaces.

*window-styles* is a list of keywords controlling various aspects of the top level window’s appearance and behavior. Each keyword is supported only on the Window systems explicitly mentioned below.

The following keywords apply to ordinary windows:

**:no-geometry-animation**

Cocoa: Programmatic changes to window geometry happen without animation.

**:hides-on-deactivate-window**

Cocoa: The window is only visible when the application is the current application.

Microsoft Windows and GTK+: The window is only visible when it is the active window.

**:toolbox**

Cocoa, Microsoft Windows and GTK+: A window with a small title bar. This window style is used in *docking-layout*.
:borderless
Cocoa, Microsoft Windows, GTK+ and Motif: A window with no external decoration or frame.

:internal-borderless
Cocoa and Motif: Remove the default border between the window’s edge and its contents.
Microsoft Windows: Remove the default border between the window's edge and its contents for dialogs.

:never-iconic
Cocoa, Microsoft Windows, GTK+ and Motif: The window cannot be minimized.

:movable-by-window-background
Cocoa and Microsoft Windows: The user can move the window by grabbing at any point not in an inner pane.

:shadowed
Cocoa: Force a shadow on windows with window style :borderless. (Other windows have a shadow by default.)
Windows XP (and later): The window has a shadow.

:shadowless
Cocoa: The window has no shadow.

:textured-background
Cocoa: The window has a textured background (like the Finder).

:always-on-top
Cocoa, Microsoft Windows and GTK+: The window is always above all other windows. Such a window is also known as a windoid.
:ignores-keyboard-input
Cocoa and GTK+: The window cannot be given the focus for keyboard input.

:no-character-palette
Cocoa: The Special Characters... menu item is not inserted automatically. (This menu item is added to the Edit menu by default.)

:motion-events-without-focus
Cocoa: output-panes in the window will see :motion input model events even if the output pane does not have the focus. This is the same behavior as on Microsoft Windows.

:can-full-screen
Cocoa: The window can be made full screen (only supported on Mac OS X 10.7 and later).

The following keywords are supported in window-styles when the interface is displayed as a dialog:

:resizable
Microsoft Windows: The dialog has a border to allow resizing. (Generally Windows dialogs do not allowing resizing.)

:contexthelp
Microsoft Windows: A '?' box appears in the window's title bar that sends help-callback type :help.

If toolbar-items is non-nil, then the interface will have a toolbar, which is typically displayed at the top of the window. The value of toolbar-items is a list of objects of type toolbar-button, toolbar-component or simple-pane, which are items that might be shown on the toolbar. The set of visible items, their order and their appearance is determined by the current toolbar-state, which can be changed if the user custom-
izes the toolbar interactively. Each toolbar-button or simple-pane in the toolbar-items list (including those within a toolbar-component) should have a name that is not cl:eql to any other item in the list. Each toolbar-button should have image and text specified, to control the image and title that is shown for the item. Each simple-pane should have toolbar-title specified, to control the title that is shown for the item.

toolbar-states is a plist containing information about the state of the toolbar. The user can also change this by customizing the toolbar, so you cannot assume that the value will be the same each time you read it. See interface-toolbar-state for a description of the keys and values in this plist.

default-toolbar-states is a plist containing information about the default state of the toolbar, which you can provide as the suggested toolbar state for the interface. The key :items will be used in the Customize Toolbar dialog as the "default" set of toolbar buttons. If both default-toolbar-states and toolbar-states are supplied, then the value of any key in toolbar-states takes precedence over that of the same key in default-toolbar-states. See interface-toolbar-state for a description of the keys and values in this plist.

pathname specifies the interface pathname. You can get and set this with the accessor interface-pathname. The pathname may be displayed in some way to the user, depending on the GUI library.

Currently, only Cocoa uses pathname, in two ways:

- It makes the interface display a drag image on the title bar (This is the same image that is set by interface-drag-image, and the drag-image takes precedence if it is not nil). The user can drag from the drag image, and if there is no drag-callback or if the drag-callback returns :default it will drag the pathname as a one item in a :filenames-
list. For information about drag-callback, see simple-pane’s description of :drag-callback and simple-pane-drag-callback.

• The context menu (invoked by right-mouse-click) on the drag image or on the title raises a menu containing the components of the path. Selecting a component opens the Finder with it.

drag-image is currently only effective on Cocoa. A non-nil value specifies that the interface should have a drag image, which on Cocoa is a small image (16x16px) to the left of the window title.

When the user drags this image, if the interface has a drag-callback it is called and if this returns non-nil LispWorks performs drag-and-drop with the image. See simple-pane for details of the drag-callback.

It is possible to have the image for aesthetic purposes only by supplying drag-image and not specifying a drag-callback. When drag-callback is non-nil, it can dynamically decide whether to allow a dragging, or to disallow dragging (by returning nil).

The image specification can be an already converted image (made by load-image, convert-external-image, make-sub-image or make-image-from-port). The image will be freed automatically when the interface is destroyed or when drag-image is set by (setf interface-drag-image). Otherwise the system uses load-image to create a new image, which is also freed automatically.

The value t for drag-image is interpreted specially: it means display some image. If drag-image is set to t after an image has already been set, it just displays the previous image. This is useful if an image was displayed but then removed by (setf interface-drag-image) with nil. If there was no previous image, a default image is displayed.
Notes

1. *create-callback* can only be used for actions that are part of the creation of the pane, that is preparing the pane for display. The *create-callback* is called before the pane is actually displayed, and therefore cannot interact with the user.

2. On Microsoft Windows F1 always calls *help-callback* if it is non-nil.

3. `(setf capi:interface-message-area)` has an effect only before display. After display, this writer has no effect unless the interface is destroyed and re-created.

4. Even though *interface* is a subclass of *titled-object*, the accessor *titled-object-message-font* cannot be used to get and set the font of the interface’s message.

5. On Cocoa in the presence of a *cocoa-default-application-interface*, an *interface* with no menus of its own and with :auto-menus nil uses the menu bar from the application interface.

Compatibility note

*interface-iconize-callback* is deprecated. Use the synonym *interface-iconify-callback* instead.

Example

```lisp
(capi:display (make-instance 'capi:interface :title "Test Interface"))

(capi:display (make-instance 'capi:interface :title "Test Interface" :destroy-callback #'(lambda (interface) (capi:display-message "Quitting -S" interface))))
```
```lisp
(capi:display (make-instance
 'capi:interface
   :title "Test Interface"
   :confirm-destroy-function
   #(lambda (interface)
      (capi:confirm-yes-or-no
       "Really quit -S"
       interface))))

(capi:display (make-instance
 'capi:interface
   :menu-bar-items
   (list
    (make-instance 'capi:menu
                   :title "Menu"
                   :items '(1 2 3)))
    :title "Menu Test"))

(setq interface
  (capi:display
   (make-instance
    'capi:interface
     :title "Test Interface"
     :layout
     (make-instance 'capi:simple-layout
                    :description
                    (list (make-instance
                           'capi:text-input-pane
                           :text "Text Pane"))))))

(capi:execute-with-interface interface
  #(setf capi:pane-layout) (make-instance
    'capi:simple-layout
    :description
    (list (make-instance
           'capi:editor-pane
           :text "Editor Pane"))))

interface)

(capi:display
  (make-instance
   'capi:interface
   :title "Test"
   :best-x 200
   :best-y 200
   :best-width '(/ :screen-width 2)
   :best-height 300))
```
The following forms illustrate the use of help-callback:
(capi:define-interface my-interface ()
()
(:panes
(a-pane
capi:text-input-pane
:help-key 'input)
(another-pane
capi:display-pane
:help-key 'output
:text "some text")
)
(:menu-bar a-menu

(:menus
(A-menu
"A menu"
("An item" :help-key "item 1")
("Another item" :help-key "item 2")
:help-key "a menu")
)
(:layouts
(main-layout
capi:column-layout
'(a-pane another-pane)))

(:default-initargs
:help-callback 'my-help-callback
:message-area t))
)

(defun do-detailed-help (interface)
  (capi:contain
(make-instance
 'capi:display-pane
:text "Detailed help for my interface"
:title
(format nil "Help for ~a" (capi:capi-object-name interface)))
)

(defun my-help-callback (interface pane type key)
  (declare (ignore pane))
  (case type
    (:tooltip (if (eq key 'input)
      "enter something"
      (when (stringp key) key)))
    (:pointer-documentation-enter
      (when (stringp key)
        (setf (capi:titled-object-message interface)
          key)))
    (:pointer-documentation-leave
      (setf (capi:titled-object-message interface)


545
"Something else")
 (:help (do-detailed-help interface ))

(make-instance 'my-interface :name "Helpful")

The following forms illustrate the use of override-cursor to set
and then remove an override cursor.

Create an interface with panes that have various different
cursors. Move the pointer across each pane.

(setf interface
 (capi:element-interface
 (capi:contain
 (loop for cursor
 in '(:crosshair :hand :v-double-arrow)
collect
 (make-instance 'capi:editor-pane
 :cursor cursor
 :text
 (format nil "-A CURSOR" cursor)))))))

Override the pane cursors by setting the override cursor on
the interface, and move the pointer across each pane again.

(setf (capi:interface-override-cursor interface) :i-beam)

Remove the override cursor.

(setf (capi:interface-override-cursor interface) :default)

This example illustrates top-level-hook. Evaluate this form and
then get an error by the interrupt gesture in the editor pane.
(For example, the interrupt gesture is Meta+Control+C on
Motif and Control+Break on Microsoft Windows). Then
select the Destroy Interface restart.
This example illustrates the use of toolbar-items:

```
(example-edit-file "capi/applications/simple-symbol-browser")
```

See also

- layout
- switchable-layout
- menu
- display
- display-dialog
- interface-display
- quit-interface
- define-interface
- activate-pane
- titled-object
- interface-document-modified-p
- interface-toolbar-state
- interface-customize-toolbar

“CAPI elements” on page 2
Chapter 2, “Getting Started”
“Window titles” on page 18
“Toolips for collections, elements and menu items” on page 35
Chapter 6, “Laying Out CAPI Panes”
Chapter 9, “Adding Toolbars”
Chapter 10, “Defining Interface Classes - top level windows”
Chapter 12, “Creating Panes with Your Own Drawing and
interface-customize-toolbar

Summary
Displays a window which allows the user to customize an interface toolbar.

Signature
interface-customize-toolbar interface

Arguments
interface
A CAPI interface.

The function interface-customize-toolbar displays a window owned by the interface interface that allows the user to customize the interface toolbar of that interface.

See Chapter 9, “Adding Toolbars” for information on how to specify an interface toolbar.

Notes
interface must be displayed at the time interface-customize-toolbar is called.

See also
interface
Chapter 9, “Adding Toolbars”

interface-display

Generic Function

Summary
The function called to display an interface on screen.

Package
capi

Signature
interface-display interface

Arguments
interface
An instance of a subclass of interface.
The generic function \texttt{interface-display} is called by \texttt{display} to display an interface on screen.

The primary method for \texttt{interface} actually does the work. You can add \texttt{:before} methods on your own interface classes for code that needs to be executed just before the interface appears, and \texttt{:after} methods for code that needs to be executed just after the interface appears.

\texttt{interface-display} is useful when you need to make changes to the interface which require it to be already be created. Font queries and loading images are typical cases.

Notes

1. \texttt{interface-display} is called in the process of \texttt{interface}.
2. \texttt{interface-display} is not called when \texttt{interface} is displayed as a dialog. Another way to run code before it appears on screen is to supply a \texttt{create-callback} for \texttt{interface}.

Example

This example shows how \texttt{interface-display} can be used to set the initial selection in a choice whose items are computed at display-time:

\begin{verbatim}
(capi:define-interface my-tree ()
  ((favorite-color :initform :blue))
 (:panes
   (tree
capi:tree-view
   :roots '(:red :blue :green)
   :print-function
   'string-capitalize))
 (:default-initargs
   :width 200
   :height 200))

(defmethod capi:interface-display :after
  ((self my-tree))
  (with-slots (tree favorite-color) self
    (setf (capi:choice-selected-item tree)
      favorite-color)))

(capi:display (make-instance 'my-tree))
\end{verbatim}
See also  

display  
interface  
Chapter 7, “Programming with CAPI Windows”  
Chapter 13, “Drawing - Graphics Ports”

interface-display-title  

Function  

Summary  
Returns the interface title to use on screen.

Package  
capi

Signature  
interface-display-title interface => string

Arguments  
interface  
A CAPI interface.

Values  
string  
A string.

Description  
The function interface-display-title returns the title to use when displaying the interface interface on screen.  
This is equivalent to:

\[
(capi:interface-extend-title interface  
(capi:interface-title interface))
\]

See also  
interface-extend-title  
set-default-interface-prefix-suffix

interface-document-modified-p  

Function  

Summary  
Gets and sets the document-modified flag in the interface.

Package  
capi

Signature  
interface-document-modified-p interface => value
(setf interface-document-modified-p) value interface

Arguments

interface A CAPI interface.

Values

value A boolean.

Description

The function interface-document-modified-p gets and sets the document-modified flag in the interface interface. Currently this only has a visible effect on Cocoa, where an interface whose document is modified is flagged by adding a dark dot in the middle of its Close button (the red button at top-left of the window).

On other platforms the document-modified state is merely remembered.

See also

interface

“Indicating a changed document” on page 151

interface-editor-pane

Generic Function

Summary

Finds an editor-pane in an interface.

Package

capi

Signature

interface-editor-pane interface => pane

Arguments

interface An instance of a subclass of interface.

Values

pane An editor-pane or nil.

Description

The generic function interface-editor-pane finds the first pane of interface that is an editor-pane, and returns it.

If there is no editor-pane, then interface-editor-pane returns nil.
interface-editor-pane may be useful when you need to apply an editor command in the process of some "random" interface, in which case you can use call-editor with the result of interface-editor-pane (if it is not nil).

See also

call-editor
editor-pane
interface

interface-extend-title

*Generic Function*

Summary
Calculates the complete interface title.

Package
capi

Signature
interface-extend-title interface title => string

Arguments
interface A CAPI interface.

  title A string.

Description
The generic function interface-extend-title is called by the system with an interface and its title before actually displaying the title on the screen. The result must be a string, which is actually displayed. There is no requirement for any relation between the title argument and the result.

The return value string is the title to display on the screen.

The default method uses the values set by set-default-interface-prefix-suffix. You can specialize interface-extend-title to get other effects.

See also

interface-display-title
set-default-interface-prefix-suffix
"Window titles” on page 18
“Controlling the appearance of the top level window” on page 150
**interface-geometry**

*Generic Function*

**Summary**
Returns the geometry of an interface. This function is deprecated. Use `top-level-interface-geometry` instead.

**Package**
capi

**Signature**
`interface-geometry interface => geometry`

**Arguments**
- `interface`
  An instance of a subclass of `interface`.

**Values**
- `geometry`
  A list.

**Description**
The generic function `interface-geometry` returns a list representing the geometry of interface in pixel values.

This function is deprecated. Use `top-level-interface-geometry` instead.

**See also**
`top-level-interface-geometry`

**interface-iconified-p**

*Function*

**Summary**
The predicate for whether an interface is iconified.

**Package**
capi

**Signature**
`interface-iconified-p pane => iconifiedp`

**Arguments**
- `pane`
  A CAPI element.

**Values**
- `iconifiedp`
  A boolean.
The function `interface-iconified-p` returns `t` if the top level interface containing `pane` is iconified. An interface is iconified when its display state as returned by `top-level-interface-display-state` is `:iconic`. This means that the window is visible as an icon, also referred to as minimized.

If the top level interface is not iconified, then `interface-iconified-p` returns `nil`.

See also `hide-interface` `top-level-interface` `top-level-interface-display-state`

### interface-keys-style

**Generic Function**

#### Summary
Determines the emulation for an interface.

#### Package
`capi`

#### Signature
`interface-keys-style interface => keys-style`

#### Arguments
`interface` An instance of a subclass of `interface`.

#### Values
`keys-style` A keyword, `:pc`, `:emacs` or `:mac`.

#### Description
The generic function `interface-keys-style` returns a keyword indicating a keys style, or `emulation`. It is called when `interface` starts running in a new process, and `keys-style` determines how user input is interpreted by output panes (including `editor-pane`) in `interface`.

The editor (that is, instances of `editor-pane` and its subclasses) responds to user input gestures according to one of three basic models.

When `keys-style` is `:emacs`, the editor emulates GNU Emacs. This value is allowed on all platforms.
When *keys-style* is :pc, the editor emulates standard Microsoft Windows keys on Windows, and KDE/Gnome keys on GTK+ and Motif. This value is allowed in the Windows, GTK+ and X11/Motif implementations.

When *keys-style* is :mac, the editor emulates Mac OS X editor keys. This value is allowed only in the Mac OS X Cocoa implementation.

The most important differences between the styles are in the handling of the Alt key on Microsoft Windows, selected text, and accelerators:

---

**:emacs**

Alt is interpreted on Microsoft Windows as the Meta key (used to access many Emacs commands).

The modifier :meta is used in an output-pane input-model gesture specification.

Control characters such as Ctrl+S are not interpreted as accelerators.

The selection is not deleted on input.

**:pc**

Alt is interpreted as Alt on Microsoft Windows and can be used for shortcuts.

The modifier :meta is not used in an output-pane input-model gesture specification.

Control keystrokes are interpreted as accelerators. Standard accelerators are added for standard menu commands, for example Ctrl+S for File > Save. For the full set of standard accelerators see “Standard default accelerators” on page 119.

The selection is deleted on input, and movement keys behave like a typical Microsoft Windows or KDE/Gnome editor.
Emacs <code>Control</code> keys are available, since they do not clash with the Macintosh <code>Command</code> key.

The selection is deleted on input, and movement keys behave like a typical Mac OS X editor.

By default <code>keys-style</code> is <code>:pc</code> on Microsoft Windows platforms and <code>:emacs</code> on Unix/Linux/AIX and Mac OS X platforms. You can supply methods for <code>interface-keys-style</code> on your own interface classes that override the default methods.

In the Cocoa implementation, <code>Command</code> keystrokes such as <code>Command</code>+$X are available if there is a suitable <code>Edit</code> menu, regardless of the Editor emulation.

See the chapter "Emulation" in the <i>LispWorks Editor User Guide</i> for more detail about the different styles.

Notes

On Motif the code to implement accelerators and mnemonics clashes with the LispWorks meta key support. Therefore the keyboard must be configured so that none of the keysyms connected to mod1 (see xmodmap) are listed in the variable <code>capi-motif-library:*meta-keysym-search-list*</code>, which must be also be non-nil. Note also that Motif requires Alt to be on mod1.

See also <code>editor-pane</code>

**interface-match-p**  
Generic Function

**Summary**

Determines whether an interface is suitable for displaying initargs.

**Package**

<code>capi</code>

**Signature**

<code>interface-match-p interface &rest initargs &key &allow-other-keys => matchp</code>
Arguments

- `interface`: An instance of a subclass of `interface`.
- `initargs`: Initargs for `interface`.

Values

- `matchp`: A boolean

Description

The generic function `interface-match-p` returns a true value if `interface` is suitable for displaying the `initargs`.

`interface-match-p` is used by `locate-interface`. When there is an existing interface for which `interface-match-p` returns true, then `locate-interface` returns it.

The default method for `interface-match-p` always returns `nil`. You can add methods for your own interface classes.

See also `locate-interface`

---

**interface-menu-groups**

**Generic Function**

Summary

Used when an embedded document sets the `menu-bar-items` to its menus, on Microsoft Windows.

Package

capi

Signature

`interface-menu-groups interface => result`

Arguments

- `interface`: A CAPI `interface`.

Values

- `result`: A list.

Description

The generic function `interface-menu-groups` is called when an embedded document sets the menu bar of its containing interface. It is called when an embedded object uses the `IOleInPlaceFrame::InsertMenus` method to add menus from the interface to its own composite menu, which is used as the menubar while the embedded object is active.
The menu bar for the embedded document includes three groups of menus that are supplied by the container (file-group, view-group, windows-group). `interface-menu-groups` is used to define these groups of menus.

`interface-menu-groups` should return a list of length 3. Each element is a list of menus. In this list, each item is either a menu object, or a cons. When it is a cons, the car is a menu object and the cdr is a string, which overrides the the title of the menu.

The default method, on interface, simply returns `(nil nil nil)`.

Notes `interface-menu-groups` is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

See also `ole-control-pane`

### interface-preserve-state

*Generic Function*

**Summary**

Called before an interface is destroyed during session saving.

**Signature**

`interface-preserve-state interface`

**Arguments**

`interface` An interface.

**Description**

The generic function `interface-preserve-state` is called by `hcl:save-current-session` just before it destroys an interface, on the interface process. You can specialize this for your own interface classes. Your methods should not interact with the user or other external sources, and should not interact with other processes, because it is called after `hcl:save-current-session` already started to destroy interfaces.

The return value is not used.

The default method does nothing.
interface-preserving-state-p

Function

Summary
The predicate for whether an interface is in "preserving-state" context.

Signature
interface-preserving-state-p interface => result

Arguments
interface An interface.

Values
result nil, t, :different-invocation or :keeping-processes.

Description
An interface enters "preserving-state" context just before it is destroyed by hcl:save-current-session, and exits the context just after interface-display returns.

If the interface interface is in "preserving-state" context, then result is either t or :different-invocation. The value t means that the current invocation of LispWorks is still the same invocation. The value :different-invocation means it is a different invocation, in other words it is the saved image that is restarted.

In other circumstances interface-preserving-state-p can return :keeping-processes, which means that the interfaces are destroyed but processes that are not associated with interface are not killed. That currently happens only on Microsoft Windows when the programmer changes the arrangement of IDE windows via Preferences... > Environment > General > Window Options.

Otherwise result is nil.

See also interface-preserving-state-p
"Preserving information when saving an IDE session" on page 107
interface-preserving-state-p is typically used in the destroy-callback of an interface or a pane to decide whether really to destroy the information, and in the create-callback or interface-display to decide whether the existing information can be used. Note that if it is a pane, it needs to find the top-level-interface.

Information that is made entirely of Lisp objects can be preserved in all cases. Information that is associated with external objects is invalid when the image is restarted. So when interface-preserving-state-p is used inside the create-callback or interface-display, external information can be preserved only if it returns t. When interface-preserving-state-p returns t, the external information may be preserved, unless it is tied to the lightweight process.

See also
interface
interface-display
interface-preserve-state
“Preserving information when saving an IDE session” on page 107

interface-reuse-p

Generic Function

Summary
Determines whether an interface is suitable for re-use.

Package
capi

Signature
interface-reuse-p interface &rest initargs &key &allow-other-keys => reusep

Arguments
interface An instance of a subclass of interface.
initargs Initargs for interface.

Values
reusep A boolean.
The generic function `interface-reuse-p` returns a true value if `interface` is suitable for reuse with `initargs`.

`interface-reuse-p` is used by `locate-interface` if no matching interface is found first by `interface-match-p`. In this case, when there is an interface for which `interface-reuse-p` returns true, then `locate-interface` reinitializes it by `reinitialize-interface` and returns it.

Notes

`interface-reuse-p` should not be confused with `reuse-interfaces-p`, which determines the global re-use state.

See also

`interface-match-p`, `locate-interface`

---

**interface-toolbar-state**

*Function*

<table>
<thead>
<tr>
<th>Signature</th>
<th><code>interface-toolbar-state</code> <code>interface</code> <code>key</code> =&gt; <code>value</code></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><code>(setf interface-toolbar-state)</code> <code>value</code> <code>interface</code> <code>key</code> =&gt; <code>value</code></td>
</tr>
</tbody>
</table>

| Arguments             | `interface` An instance of `interface` or a subclass. |
|                       | `key` One of the `toolbar-states` plist keys.       |
|                       | `value` The value associated with the `toolbar-states` plist key. |

| Values                | `value` The value associated with the `toolbar-states` plist key. |

| Description           | The functions `interface-toolbar-state` and `(setf interface-toolbar-state)` read or change the properties of an interface toolbar that give information about its state. The user can also change these properties by customizing the toolbar, so you cannot assume that the value will be the same each time you read it. |
See Chapter 9, “Adding Toolbars” for information on how to specify an interface toolbar.

key can be one of the following, with the corresponding value:

- **visible**: visible is true if the toolbar is visible and false if it is hidden. The default is true.

- **items**: items is a list of the names of the toolbar-items which are shown on the toolbar, in the order they are shown. The built-in names :separator, :space and :flexible-space represent various kinds of gap between items. On Microsoft Windows, an item can be a list of the form (:titled-separator title) which starts a dockable group of items that displays title when it is undocked. The default items includes all items in toolbar-items, with :separator between each toolbar-component.

- **display**: display is a keyword describing what is displayed for each item. It can be :image (just shows an image), :title (just shows the title), :image-and-title (shows both title and image) or :image-and-title-horizontal (shows title and image horizontally, only supported on GTK+). The default is platform-specific.

- **size**: size is a keyword describing the size of the items. It can be one of :small, :normal or :large. Some of these sizes might be the same as others. The default is platform-specific.

You can set all of the keys simultaneously by setting the interface-toolbar-state accessor or providing the toolbar-states initarg.
Notes The value :separator in items may or may not actually be visible, depending on the windowing system. On Max OS X Lion it is zero width.

See also interface
interface-customize-toolbar
Chapter 9, “Adding Toolbars”

interface-visible-p Function

Summary The predicate for whether the interface containing a pane is visible.

Package capi

Signature interface-visible-p pane => visiblep

Arguments pane A CAPI pane.

Values visiblep A boolean.

Description The function interface-visible-p returns nil if

1. pane is not associated with any interface, or
2. pane is associated with an interface which is not displayed, or
3. pane is associated with an interface which is minimized or iconified, or
4. pane is known to be fully obscured by other windows. This can happen on Motif, but is not detected on Microsoft Windows.

An error is signalled if pane is not a CAPI pane (that is, it is not an instance of a subclass of element, collection or pin-board-object).
Otherwise `interface-visible-p` returns `t`.

Notes
On Microsoft Windows, `interface-visible-p` may return `t` even though the interface is entirely obscured by another window.

**interpret-description**

**Generic Function**

**Summary**
Converts an abstract description of a layout's children into a list of objects.

**Package**
capi

**Signature**
`interpret-description layout description interface => result`

**Arguments**
- `layout` A layout.
- `description` A list, or other Lisp object accepted for some layout class.
- `interface` An interface.

**Values**
- `result` A list, each element being a `simple-pane`, a `pinboard-object` or a geometry object.

**Description**
The generic function `interpret-description` is used by the layout mechanism to translate an abstract description of layout's children (supplied by the initarg `:description` or `(setf layout-description)`) into a list of objects to actually use. Each object must be either an element (an object of type `simple-pane` or of type `pinboard-object`) or a geometry object (the result of the default method of `parse-layout-descriptor`).

The default method specialized on `layout` expects `description` to be a list, and returns a list of the values returned by `parse-layout-descriptor` for each element. Some built-in sub-
classes of layout have their own methods, which allow different values of description. In these cases the manual page for the layout class describes what the description can be.

For example, column-layout expects as its description a list of items where each item in the list is either the slot-name of the child or a string which should be turned into a title pane. This is the default handling of a layout’s description, which is done by calling the generic function parse-layout-descriptor to do the translation for each item.

You can define a method for your own layout class. The elements in the returned list must not be returned more than once for layouts that are displayed at the same time.

See also

parse-layout-descriptor
define-layout
layout
Chapter 6, “Laying Out CAPI Panes”

invalidate-pane-constraints

Function

Summary
Causes the resizing of a pane if its minimum and maximum size constraints have changed. It returns t if resizing was necessary.

Package
capi

Signature
invalidate-pane-constraints pane

Description
This function informs the CAPI that pane’s constraints (its minimum and maximum size) may have changed. The CAPI then checks this, and if the pane is no longer within its constraints it resizes it so that it is and then makes the pane’s parent layout lay its children out and display them again at their new positions and sizes. If the pane is resized, then invalidate-pane-constraints returns t.
21 CAPI Reference Entries

See also `get-constraints` `layout` `element` `define-layout` Chapter 6, “Laying Out CAPI Panes”

**invoke-command**

*Function*

**Summary**

Invokes a command in the input model for a specified output pane.

**Package**

capi

**Signature**

```
invoke-command command output-pane &rest event-args
```

**Description**

This invokes the command in the input model for the given `output-pane`, with the translator being called to process the gesture information. To avoid the translation, use `invoke-untranslated-command`.

**See also**

`invoke-untranslated-command` `define-command` `output-pane` “Commands - aliases” on page 186

**invoke-untranslated-command**

*Function*

**Summary**

Invokes a command in the input model for a specified output pane, without the translator being called.

**Package**

capi

**Signature**

```
invoke-untranslated-command command output-pane &rest event-args
```
Description

The function `invoke-untranslated-command` invokes the command in the input model for the given `output-pane`, without the translator being called to process the gesture information. To perform the translation, use `invoke-command`.

See also

`invoke-command`
`define-command`
`output-pane`
“Commands - aliases” on page 186

---

**item**

**Class**

**Summary**

The class `item` groups together a title, some data and some callbacks into a single object for use in collections and choices.

**Package**

capi

**Superclasses**

callbacks
capi-object

**Subclasses**

menu-item
button
item-pinboard-object
popup-menu-button
toolbar-button

**Initargs**

:collection The collection in which item is displayed
:data The data associated with the item.
:text The text to appear in the item (or nil).
:print-function

If `text` is nil, this is called to print the data.

:selected If t the item is selected.
An item can provide its own callbacks to override those specified in its enclosing collection, and can also provide some data to get passed to those callbacks.

An item is printed in the collection by print-collection-item. By default this returns a string using item’s text if specified, or else calls a print function on the item’s data. The print-function will either be the one specified in the item, or else the print-function for its parent collection.

The selected slot in an item is non-nil if the item is currently selected. The accessor item-selected is provided to access and to set this value.

Example

(defun main-callback (data interface)
  (capi:display-message "Main callback: ~S" data))

(defun item-callback (data interface)
  (capi:display-message "Item callback: ~S" data))

(capi:contain (make-instance
    'capi:list-panel
    :items (list
        (make-instance
          'capi:item
          :text "Item"
          :data '(some data)
          :selection-callback
          'item-callback)
        "Non-Item 1"
        "Non-Item 2")
        :selection-callback 'main-callback))
See also

item

collection

choice

print-collection-item

Chapter 9, “Adding Toolbars”

### item-pane-interface-copy-object

*Generic Function*

#### Summary

Determines what `pane-interface-copy-object` returns from a `choice`.

#### Signature

```
item-pane-interface-copy-object item choice interface =>
object, string, plist
```

#### Description

The generic function `item-pane-interface-copy-object` is used by the method of `pane-interface-copy-object` that specializes on `choice` to decide what to return.

If only one item is selected, the `pane-interface-copy-object` method for `choice` returns what `item-pane-interface-copy-object` returns for this item. In this case all three of the return values are used.

If multiple items are selected, `pane-interface-copy-object` applies `item-pane-interface-copy-object` to each one, and returns a list of the returned objects as the first value, and a concatenation of returned strings (separated by newlines) as the second value. The plist is ignored if there are more than one element.

The default method returns the item and its print representation (using the `print-function` of the `choice`), and no third return value.

You can define your own methods for `item-pane-interface-copy-object`. This is useful to make `active-pane-copy` work properly for a `choice`, in cases where the actual
items in the choice are not the objects that are displayed in the choice as far as the user is concerned. For example, you may have a structure

(defstruct my-item
  real-object
  color)

To give different colors to different lines in a list-panel. In this case pane-interface-copy-object (and hence active-pane-copy when the list-panel is active) will return the my-item structure, while the user will expect the real object. This can be fixed by adding a method:

(defmethod item-pane-interface-copy-object
  ((item my-item) pane interface)
  (let ((real-object (my-item-real-object item)))
    (values real-object
            (print-a-real-object real-object))))

See also pane-interface-copy-object
active-pane-copy
“Edit actions on the active element” on page 104

**item-pinboard-object**

*Class*

**Summary**

An item-pinboard-object is a pinboard-object that displays a single piece of text.

**Package**
capi

**Superclasses**

pinboard-object
item

**Description**
The class item-pinboard-object displays an item on a pinboard layout. It displays the text specified by the item in the usual way (either by the text field, or through printing the data with the print function).
Example

(capi:contain (make-instance 'capi:item-pinboard-object 
:text "Hello World"))

(capi:contain (make-instance 'capi:item-pinboard-object 
:data :red 
:print-function 
'string-capitalize))

See also

image-pinboard-object
pinboard-layout
“Creating graphical objects” on page 187

itemp

Generic Function

Package capi

Signature itemp object

Description This is equivalent to

(typep object 'capi:item)

See also item collection

labelled-arrow-pinboard-object

Class

Package capi

Superclasses arrow-pinboard-object labelled-line-pinboard-object

Description A subclass of pinboard-object which displays an arrow
and draws a label on it.

Example See labelled-line-pinboard-object.
See also  

pinboard-layout

“Creating graphical objects” on page 187

**labelled-line-pinboard-object**  

*Class*

**Summary**

A subclass of *pinboard-object* which draws a labelled line.

**Package**

capi

**Superclasses**

item-pinboard-object  
line-pinboard-object

**Subclasses**

labelled-arrow-pinboard-object

**Initargs**

:text-foreground

A valid color specification, as defined for the *graphics-state* parameter *foreground*.

:text-background

A valid color specification, as defined for the *graphics-state* parameter *foreground*, or the keyword :background, or nil.

**Accessors**

labelled-line-text-foreground  
labelled-line-text-background

**Description**

A subclass of *pinboard-object* which displays a line and draws a label in the middle of it.

Note that the label text is inherited from *item*.

text-foreground defines the color of the label text.

text-background defines the background for the text, which is the color used to draw a filled rectangle in the area of the text before drawing the text. The value :background means use the background of the pinboard-layout of the object. The value nil means do not draw a background rectangle. The default value of text-background is :background.
Notes   For a description of color specifications, see “Color specs” on page 243.

Example   (capi:contain
          (make-instance
           'capi:pinboard-layout
           :description
           (list (make-instance
                   'capi:labelled-line-pinboard-object
                   :text "Labelled Line"
                   :start-x 10 :start-y 10
                   :end-x 80 :end-y 60)
                   (make-instance
                   'capi:labelled-arrow-pinboard-object
                   :text "Labelled Arrow"
                   :start-x 10 :start-y 70
                   :end-x 80 :end-y 120
                   :head-direction :both)))))

See also   graphics-state
           pinboard-layout
           “Creating graphical objects” on page 187

layout   Class

Summary   A layout is a simple pane that positions one or more child panes within itself according to a layout policy.

Package   capi

Superclasses   titled-object
               simple-pane

Subclasses   simple-layout
             grid-layout
             pinboard-layout

Initargs   :default   A flag to mark the default layout for an interface.
           :description The list of the layout’s children.
Accessors

layout-description

Description

The layout’s description is an abstract description of the children of the layout, and each layout defines its format. Generally, description is a list, each element of which is one of:

- An element, that is an object of type simple-pane or pinboard-object.
- A slot name, where the name refers to a slot in the layout’s interface containing an element.
- A string, where the string gets converted to a title-pane or an item-pinboard-object.

Note that pinboard-objects can be used only when the hierarchy contains pinboard-layout.

Some subclasses of layout have different syntax for description, for example grid-layout (and its subclasses row-layout and column-layout) allows arrays too, and it also accepts nil in the description list.

Setting the layout description causes the layout to translate it, and then to layout the new children, adjusting the size of its parent if necessary. The actual translation is done by interpret-description.

A number of default layouts are provided which provide the majority of layout functionality that is needed. They are as follows:

- simple-layout A layout for one child.
- row-layout Lays its children out in a row.
- column-layout Lays its children out in a column.
- grid-layout Lays its children out in an n by m grid.
pinboard-layout
Places its children where the user specifies.

switchable-layout
Keeps only one of its children visible.

*initial-focus* specifies which child of the layout has the input focus when the layout is first displayed. Panes are compared by `cl:eq` or `capi-object-name`. See `pane-initial-focus` for more information about the initial focus pane.

See also `define-layout`
`interpret-description`
Chapter 6, “Laying Out CAPI Panes”

**line-pinboard-object**

*Class*

**Summary**
A subclass of `pinboard-object` which displays a line drawn between two corners of the area enclosed by the pinboard object.

**Package**
capi

**Superclasses**
`pinboard-object`

**Subclasses**
`arrow-pinboard-object`
`right-angle-line-pinboard-object`

**Initargs**  
`:start-x` The x coordinate of the start of the line.  
`:start-y` The y coordinate of the start of the line.  
`:end-x` The x coordinate of the end of the line.  
`:end-y` The y coordinate of the end of the line.
Description

start-x, start-y, end-x and end-y default to values computed from the x, y, width and height. They are used to compute the size of the object, and the proper value of x and y. Note that width and height may be larger, for example to accommodate the label in a labelled-line-pinboard-object, and the x and y are adjusted for that.

To change the end points of the line, call move-line.

A complementary class right-angle-line-pinboard-object is provided which draws a line around the edge of the pinboard object.

Example

{capi:contain
  (make-instance
   'capi:line-pinboard-object
     :start-x 0 :end-x 100
     :start-y 100 :end-y 0))

See also

move-line
pinboard-layout
"Creating graphical objects" on page 187

### line-pinboard-object-coordinates

**Function**

<table>
<thead>
<tr>
<th>Summary</th>
<th>Returns the coordinates of a line-pinboard-object.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>capi</td>
</tr>
<tr>
<td>Signature</td>
<td>line-pinboard-object-coordinates object =&gt; start-x, start-y, end-x, end-y</td>
</tr>
<tr>
<td>Arguments</td>
<td>object</td>
</tr>
<tr>
<td>Values</td>
<td>start-x</td>
</tr>
<tr>
<td></td>
<td>start-y</td>
</tr>
<tr>
<td></td>
<td>end-x</td>
</tr>
</tbody>
</table>
Description

The function `line-pinboard-object-coordinates` returns the start and end coordinates of the `line-pinboard-object` object.

See also

move-line

---

**list-panel**

*Class*

**Summary**

A pane that displays a group of items and provides support for selecting items and performing actions on them. Each item may optionally have an image.

**Package**

capi

**Superclasses**

choice
  simple-pane
  sorted-object
  titled-object

**Subclasses**

list-view
  multi-column-list-panel

**Initargs**

: right-click-selection-behavior
  A keyword or `nil`. Controls the behavior on a right mouse button click.

: color-function
  A function designator or `nil`. Controls item text color on Microsoft Windows, Cocoa and GTK+.

: alternating-background
  A boolean influencing the use of alternating background color on Cocoa and GTK+.

: filter
  A boolean. The default value is `nil`.  

end-y An integer.
The following initargs take effect only when \textit{filter} is non-nil.

\begin{description}
\item[:\texttt{filter-automatic-p}] A boolean. The default value is \texttt{t}.
\item[:\texttt{filter-callback}] A function designator or the keyword \texttt{default}, which is the default value.
\item[:\texttt{filter-change-callback-p}] A boolean.
\item[:\texttt{filter-short-menu-text}] A boolean. The default value is \texttt{nil}.
\item[:\texttt{filter-matches-title}] A string, \texttt{t} or \texttt{nil}.
\item[:\texttt{filter-help-string}] A string, \texttt{t} or \texttt{nil}.
\item[:\texttt{keyboard-search-callback}] A function that is used to search for an item when the user types ordinary characters.
\end{description}

Initargs for handling images:

\begin{description}
\item[:\texttt{image-function}] Returns an image for an item.
\item[:\texttt{state-image-function}] Returns a state image for an item.
\item[:\texttt{image-lists}] A plist of keywords and \texttt{image-list} objects.
\item[:\texttt{use-images}] Flag to specify whether items have images. Defaults to \texttt{t}.
:use-state-images
Flag to specify whether items have state images. Defaults to nil.

:image-width  Defaults to 16.
:image-height  Defaults to 16.

:state-image-width
Defaults to image-width.

:state-image-height
Defaults to image-height.

Accessors
list-panel-right-click-selection-behavior
list-panel-keyboard-search-callback
list-panel-image-function
list-panel-state-image-function

Description
The class list-panel gains much of its behavior from choice, which is an abstract class that handles items and their selection. By default, a list panel has both horizontal and vertical scrollbars.

list-panel does not support the :no-selection interaction style. For a non-interactive list use a display-pane.

To scroll a list-panel, call scroll with scroll-operation :move.

mnemonic-title is interpreted as for menu.

color-function allows you to control the text colors on Microsoft Windows, Cocoa and GTK+. If color-function is non-nil, then it is a function used to compute the text color of each item, with signature

color-function list-panel item state => result

When alternating-background is true, the list panel is drawn with alternating background on Cocoa. On GTK+ it provides a hint, which the theme can override. Experience suggests
that theme may draw with alternating background even when `alternating-background` is false, but when it is true they tend to draw it always. The default value of `alternating-background` is `nil`.

`state` is a keyword representing the state of the item. It can be one of `:normal`, `:selected` or `:disabled`. The value `result` should be a value suitable for the function `convert-color`. The pane uses the converted color as the foreground color for the item `item`. `color-function` is called while `list-panel` is being drawn, so it should not do heavyweight computations.

Description: Filter

If `filter` is non-nil, the system automatically adds a `filtering-layout` above the list. The items in the `list-panel` are filtered by the value in the `filtering-layout`. Filtering displays only those items whose print representation matches the filter. (The print representation is the result of `print-collection-item`, and is what the user sees.) Only the items that match, or those that do not match if `Exclude` is set, are displayed in the `list-panel`.

Here filtering means mapping over the unfiltered items, collecting each item that matches the current setting in the filter, and then setting the items of the `list-panel` to the collected items.

For a `list-panel` with a filter, `collection-items` returns only the filtered items, and the selection (that is, the result of `choice-selection` and the argument to `(setf choice-selection)`) index into the filtered items.

Calling `(setf collection-items)` on a filtered `list-panel` sets an internal unfiltered list, and then clears the filtering so that all items are visible.

To get and set the unfiltered items, use the accessor `list-panel-unfiltered-items`. To access the filter-state, use `list-panel-filter-state`. To access both the unfiltered
items and the filter simultaneously, which is especially useful when setting both of them at the same time, use \texttt{list-panel-items-and-filter}.

\texttt{filter-automatic-p} controls whether the filter automatically does the filtering whenever the text in the filter changes, and \texttt{filter-callback} defines the callback of the \texttt{filtering-layout}.

If \texttt{filter-automatic-p} is \texttt{t}, whenever a change occurs in the filter the list is refreshed against the new value in the filter. The \texttt{filter-callback} (if non-nil) is called with two arguments, the \texttt{filtering-layout} and the \texttt{list-panel} itself, when the user "confirms" (that is, she presses \texttt{Return} or clicks the \texttt{Confirm} button). If \texttt{filter-automatic-p} is false and \texttt{filter-callback} is \texttt{:default}, then the \texttt{filtering-layout} is given a callback that does the filtering when the user "confirms". If \texttt{filter-automatic-p} is false and \texttt{filter-callback} is non-nil, then no filtering is done explicitly, and it is the responsibility of the callback to do any filtering that is required.

\texttt{filter-matches-title} (default \texttt{t}) and \texttt{filter-help-string} (default \texttt{t}) are passed down to the filtering layout through the corresponding \texttt{filtering-layout} initargs:

\begin{verbatim}
filter-matches-title :matches-title
filter-help-string  :help-string
\end{verbatim}

See \texttt{filtering-layout} for a description of these initargs.

If \texttt{filter-short-menu-text} is true, the filter menu has a short title. For example if the filter is set for case-sensitive plain inclusive matching the short label is \texttt{PMC}. If \texttt{filter-short-menu-text} were false then this label would be \texttt{Filter:C}.

\textbf{Notes: Filter}

1. You should not rely on the \texttt{element-parent} of the \texttt{list-panel}, because it is implemented by wrapping some layouts around the \texttt{list-panel}. 

581
2. The filter is actually a filtering layout, so it has the same interactive semantics as `filtering-layout`.

**Description:**

`keyboard-search-callback` should be a function with signature:

```lisp
keyboard-search-callback pane string position => index, last-match, last-match-reset-time
```

`pane` is the `list-panel`, `string` is a string to match and `position` is the item index from which the system thinks that the search should start.

`string` contains the character that the user typed, appended to the "last match", if there is one. There is a "last match" if the previous call to `keyboard-search-callback` returned it (see below).

`index` is an index in the `collection-items` to move to. Apart from an integer inside the items range of the `list-panel`, this can be `nil`, which means do nothing, or `:no-change`, which selects the current item.

`last-match` is a string that should be recorded as the "last match" (if it is not a string, the "last match" is reset). This is prepended to the character in the next call, if the character is typed before the "last match" is reset.

`last-match-reset-time` is the time to wait before resetting the "last match", in seconds. Once this time passes, the last match is reset to `nil`. If `last-match-reset-time` is `nil`, the default value (which defaults to 1) is used. This default value can be changed by `set-list-panel-keyboard-search-reset-time`.

You can simplify the implementation of `keyboard-search-callback` by using `list-panel-search-with-function`.

As a special case, passing `:keyboard-search-callback t` tells CAPI to use its own internal search mechanism in preference to the native one. That can be useful on GTK+, where the default is to use the native search mechanism (for GTK+ versions after 2.4).
keyboard-search-callback is intended for searching, but it is not limited to doing a search, and in fact can be used for implementing other functionality. However, since the system waits for the result, if the callback does something heavy or interacts with the user, it should schedule it in some way and return, for example:

```lisp
(defun my-keyboard-search-callback (pane string pos)
  (declare (ignore pane pos))
  ;; cause a call to display-message in event loop
  (mp:current-process-send
   (list 'capi:display-message
     (format nil "You pressed ~a" string)))
  nil ;; return nil so do nothing)
```

Description:
Images

The image-function is called on an item to return an image associated with the item. It can return one of the following:

A pathname or string

This specifies the filename of a file suitable for loading with load-image. Currently this must be a bitmap file.

A symbol


On Microsoft Windows, the following symbols are also recognized. They map to view images: :view-large-icons, :view-small-icons, :view-list, :view-details, :view-sort-name, :view-sort-size, :view-sort-date, :view-sort-

Also on Microsoft Windows, these symbols are recognized. They map to history images: :hist-back, :hist-forward, :hist-favorites, :hist-addtofavorites and :hist-viewtree.

An image object, as returned by load-image.

An image locator object

This allowing a single bitmap to be created which contains several button images side by side. See make-image-locator for more information. On Microsoft Windows, it also allows access to bitmaps stored as resources in a DLL.

An integer

This is a zero-based index into the list panel’s image lists. This is generally only useful if the image list is created explicitly. See image-list for more details.

The state-image-function is called on an item to determine the state image: an additional optional image used to indicate the state of an item. It can return one of the above, or nil to indicate that there is no state image.

If image-lists is specified, it should be a plist containing the following keywords as keys. The corresponding values should be image-list objects.

:normal

Specifies an image-list object that contains the item images. The image-function should return a numeric index into this image-list.
:state

Specifies an image-list object that contains the state images. The state-image-function should return a numeric index into this image-list.

Description:

right-click-selection-behavior can take the following values:

nil 
Corresponds to the behavior in LispWorks 4.4 and earlier. The data is not passed.

All non-nil values pass the clicked item as data to the pane-menu:

:existing-or-clicked/restore/discard

If the clicked item is not already selected, make it be the entire selection while the menu is displayed. If the clicked item is already selected, do not change the selection. If the menu is cancelled, the original selection is restored. If the user chooses an item from the menu, the selection is not restored.

:temporary-selection

A synonym for :existing-or-clicked/restore/discard.

:existing-or-clicked/restore/restore

If the clicked item is not already selected, make it be the entire selection while the menu is displayed. If the clicked item is already selected, do not change the selection. If the user chooses an item from the menu and the item’s callback does not set the selection then the original selection is restored after the callback. If the callback sets the selection, then this selection remains. The original selection is restored if the user cancels the menu.
:temporary-restore
A synonym for :existing-or-clicked/restore/restore.

:clicked/restore/discard
Make the clicked item be the entire selection while the menu is displayed. If the menu is cancelled, the original selection is restored. If the user chooses an item from the menu, the selection is not restored.

:temporary-always
A synonym for :clicked/restore/discard.

:clicked/restore/restore
Make the clicked item be the entire selection while the menu is displayed. If the user chooses an item from the menu and the item’s callback does not set the selection then the original selection is restored after the callback. If the callback sets the selection, then this selection remains. The original selection is restored if the user cancels the menu.

:existing-or-clicked/discard/discard
If the clicked item is not already selected, make it be the entire selection while the menu is displayed. If the clicked item is already selected, do not change the selection. The original selection is never restored, regardless of whether the user chooses an item from the menu or cancels the menu.

:discard-selection
A synonym for :existing-or-clicked/discard/discard.
:clicked/discard/discard

Make the clicked item be the entire selection. The original selection is never restored, regardless of whether the user chooses an item from the menu or cancels the menu.

:discard-always

A synonym for :clicked/discard/discard.

:no-change

Does not affect the selection, but the clicked item is nonetheless passed as the data.

The default value of right-click-selection-behavior is :no-change.

Example

```lisp
(setq list (capi:contain
  (make-instance 'capi:list-panel
    :items '(:red :blue :green)
    :selected-item :blue
    :print-function
    'string-capitalize)))

(capi:apply-in-pane-process
 list #'(setf capi:choice-selected-item) :red list)

(capi:apply-in-pane-process
 list #'(setf capi:choice-selected-item) :green list)

(capi:contain (make-instance
  'capi:list-panel
  :items '(:red :blue :green)
  :print-function 'string-capitalize
  :selection-callback
  #'(lambda (data interface)
      (capi:display-message
      "-S" data))))

This example illustrates the use of :right-click-selection-behavior:
```
(capi:define-interface click ()
  ((keyword :initarg :right-click-selection-behavior))
  (:panes
    (list-panel
capi:list-panel
   :items '("foo" "bar" "baz" "quux")
   :visible-min-height '(:character 4)
   :pane-menu 'my-menu
   :interaction :multiple-selection
   :right-click-selection-behavior keyword)))

(defun my-menu (pane data x y)
  (declare (ignore pane x y))
  (make-instance 'capi:menu
    :items (list "Hi There"
           ==
             "Here's the data:
             data))

(capi:display
  (make-instance 'click
    :right-click-selection-behavior
    :clicked/restore/restore))

See also this example:

(example-edit-file "capi/choice/list-panel-pane-menu")

There are further examples here:

(example-edit-file "capi/choice/")

This example illustrates the use of color-function:

(example-edit-file "capi/applications/simple-symbol-browser")

There are further examples in Chapter 20, “Self-contained examples”.

See also button-panel
double-list-panel
“CAPI elements” on page 2
“Controlling Mnemonics” on page 13
“Matching resources for GTK+” on page 269
Chapter 5, “Choices - panes with items”
list-panel-enabled  Generic Function

Summary  Gets or sets the enabled state of a list-panel. This function is deprecated.

Package  capi

Signature  list-panel-enabled  list-panel  =>  enabledp

Signature  (setf list-panel-enabled)  enabledp  list-panel  =>  enabledp

Arguments  list-panel  A list-panel.

Values  enabledp  A boolean.

Description  The generic function list-panel-enabled gets or sets the enabled state of a list-panel.

Notes  list-panel-enabled is deprecated because it is equivalent to the simple-pane accessor simple-pane-enabled. Use simple-pane-enabled instead.

See also  simple-pane

list-panel-filter-state  Generic Function

Summary  Accesses the state of the filter in a filtered list-panel.

Signature  list-panel-filter-state  list-panel  =>  filter-state

(setf list-panel-filter-state)  new-state  list-panel
**Description**
The generic function `list-panel-filter-state` accesses the state of the filter in a filtered `list-panel` (that is, a `list-panel` created with `filter t`).

`list-panel-filter-state` returns the state of the filter in `list-panel`. The return value `filter-state` is the same type as the state that is used in `filtering-layout`.

`(setf list-panel-filter-state)` sets the filter in `list-panel`, filters the unfiltered items and displays those that match the `new-state`. The `new-state` has the same semantics as the `new-value` of `(setf filtering-layout-state)`. It can be a result of a call to `list-panel-filter-state` or to `filtering-layout-state` (on a `filtering-layout`), or a string (meaning plain match, case-insensitive), or `nil` (meaning match everything).

On an unfiltered `list-panel list-panel-filter-state` returns `nil`, and `(setf list-panel-filter-state)` does nothing.

**See also**
- `list-panel`
- `list-panel-unfiltered-items`
- `filtering-layout`

---

**list-panel-items-and-filter**

**Function**

**Summary**
Accesses the unfiltered items and filter in a `list-panel`

**Signature**

```
list-panel-items-and-filter list-panel => unfiltered-items, filter-state

(setf list-panel-items-and-filter) (values new-items new-filter-state) list-panel
```

**Description**
The function `list-panel-items-and-filter` accesses the unfiltered items and the state of the filter in the list panel `list-panel` simultaneously. It is especially useful for setting the filter state and the items without flickering.
list-panel-items-and-filter returns the items and filter state in list-panel as multiple values. It is equivalent to

```
(values (list-panel-unfiltered-items list-panel)
         (list-panel-filter-state list-panel))
```

but is more efficient.

The return value filter-state is the same type as the state that is used in filtering-layout.

(setf list-panel-items-and-filter) takes the items and new filter state as two values and sets them in list-panel:

These two forms:

```
(setf (list-panel-items-and-filter list-panel)
      (values new-items new-filter-state))
```

```
(progn
  (setf (list-panel-unfiltered-items list-panel) new-items)
  (setf (list-panel-filter-state list-panel) new-filter-state)
)
```

have the same ultimate effect on list-panel, but the latter form will filter the new-items with the old filter and display the result and then filter the new-items again with the new-filter-state, whereas (setf list-panel-items-and-filter) filters the new-items just once, with the new-filter-state.

See also

list-panel
list-panel-filter-state
list-panel-unfiltered-items

### list-panel-search-with-function

**Function**

**Summary**

Searches a list-panel.

**Signature**

`list-panel-search-with-function list-panel function arg &key start-index wrap-around reset-time`

**Arguments**

- `list-panel`  
  A list-panel.
function A function taking two arguments. The first is arg, the second is an item in list-panel.

arg Any Lisp object.

start-index An integer, default 0.

reset-time A real number. The default is an internal value which can be set by set-list-panel-keyboard-search-reset-time.

wrap-around A boolean, default t.

Description The function list-panel-search-with-function searches list-panel using function. list-panel-search-with-function is intended to simplify the implementation of the keyboard-search-callback of list-panel.

list-panel-search-with-function searches list-panel for a match. It applies function to each item and arg, until function returns non-nil.

When function returns non-nil, list-panel-search-with-function returns three values: the index of the item, arg, and reset-time.

The search starts at start-index if supplied, and at 0 otherwise. When the search reaches the end of the list panel and it did not start from 0, it wraps around to the beginning, unless wrap-around is supplied as nil. The default value of wrap-around is t.
Example

(defun string-equal-prefix (string item)
  (let* ((start 0)
         (len (length item))
         (end (+ start (length string))))
    (and (>= len end)
         (string-equal string item
                        :start2 start
                        :end2 end))))

(capi:contain
 (make-instance
 'capi:list-panel
 :items '("ae" "af" "bb" "cc")
 :keyboard-search-callback
 #'(lambda (pane string position)
    (capi:list-panel-search-with-function
     pane
     'string-equal-prefix ; or 'string-not-greaterp
     string
     :start position
     :reset-time 1
     :wrap-around t))))

Pressing "a" slowly cycles between "ae" and "af". Running the same example with string-not-greaterp instead causes "a" to cycle around all of the items.

See also

list-panel
set-list-panel-keyboard-search-reset-time
“Searching by keyboard input” on page 54

list-panel-unfiltered-items

Generic Function

Summary
Accesses the unfiltered items of a filtered list-panel.

Signature
list-panel-unfiltered-items list-panel

(setf list-panel-unfiltered-items) new-items list-panel

Description
The generic function list-panel-unfiltered-items accesses the unfiltered items of a filtered list-panel (that is, a list-panel created with :filter t).
list-panel-unfiltered-items returns the unfiltered items of list-panel (that is all of them, as opposed to the accessor collection-items, which returns only those items that match the filter).

(setf list-panel-unfiltered-items) sets the items of list-panel without affecting the filter (as opposed to (setf collection-items) which resets the filter). The items are then filtered, and only those that match the filter are displayed.

list-panel-unfiltered-items behaves the same as collection-items when called on an unfiltered list-panel.

See also
list-panel
list-panel-items-and-filter
list-panel-filter-state

list-view

Class

Summary
The list view pane is a choice that displays its items as icons and text in a number of formats.

Note: list-view is not implemented on Cocoa

Package
capi

Superclasses
list-panel

Initargs
:view Specifies which view the list view pane shows. The default is :icon.

:subitem-function
Returns additional information to be displayed in report view.
:subitem-print-functions
  Used in report view to print the additional information.

:image-function
  Returns an image for an item

:state-image-function
  Returns a state image for an item.

:image-lists
  A plist of keywords and image-list objects.

:columns
  Defines the columns used in report view

:auto-reset-column-widths
  Determines whether columns automatically resize. Defaults to :all.

:auto-arrange-icons
  Determines whether icons are automatically arranged to fit the size of the window.

:use-large-images
  Indicates whether large icons will be used (generally only if the icon view will be used). Defaults to t.

:use-small-images
  Indicates whether small icons will be used. Defaults to t.

:use-state-images
  Indicates whether state images will be used. Defaults to nil.

:large-image-width
  Width of a large image. Defaults to 32.
:large-image-height
   Height of a large image. Defaults to 32.

:small-image-width
   Width of a small image. Defaults to 16.

:small-image-height
   Height of a small image. Defaults to 16.

:state-image-width
   Width of a state image. Defaults to small-image-width.

:state-image-height
   Height of a state image. Defaults to small-image-height.

Accessors
list-view-view
list-view-subitem-function
list-view-subitem-print-functions
list-view-image-function
list-view-state-image-function
list-view-columns
list-view-auto-reset-column-widths
list-view-auto-arrange-icons

Description
The list view inherits its functionality from choice. In many ways it may be regarded as a kind of enhanced list panel, although its behavior is not identical. It supports single selection and extended selection interactions.

The list view displays its items in one of four ways, determined by the value in the view slot. An application may use the list view pane in just a single view, or may change the view between all four available views using (setf list-view-view).

See the notes below on using both large and small icon views.

In all views, the text associated with the item (the label) is returned by the print-function, as with any other choice.
• The icon view — :icon.
In this view, large icons are displayed, together with their label, positioned in the space available. See also auto-arrange-icons, below.

• The small icon view — :small-icon.
In this view, small icons are displayed, together with their label, positioned in the space available. See also auto-arrange-icons, below.

• The list view — :list.
In this view, small icons are displayed, arranged in vertical columns.

• The report view — :report.
In this view, multiple columns are displayed. A small icon and the item’s label is displayed in the first column. Additional pieces of information, known as subitems, are displayed in subsequent columns.

To use the view :report, columns must specify a list of column specifiers. Each column specifier is a plist, in which the following keywords are valid:

:title The column heading.
;width The width of the column in pixels. If this keyword is omitted or has the value nil, the width of the column is automatically calculated, based on the widest item to be displayed in that column.
:align May be :left, :right or :center to indicate how items should be aligned in this column. The default is :left. Only left alignment is available for the first column.

If auto-arrange-icons is true, then the icons are automatically arranged to fit the size of the window when the view is showing :icon or :small-icon. The default value of auto-arrange-icons is nil.
The `subitem-function` is called on the item to return subitem objects that represent the additional information to be displayed in the subsequent columns. Hence, `subitem-function` should normally return a list, whose length is one less than the number of columns specified. Each subitem is then printed in its column using the appropriate subitem print function. `subitem-print-function` may be either a single print function, to be used for all subitems, or a list of functions: one for each subitem column.

Note that the first column always contains the item label, as determined by the `choice-print-function`.

The `image-function` is called on an item to return an image associated with the item. It can return one of the following:

A pathname or string

This specifies the filename of a file suitable for loading with `load-image`. Currently this must be a bitmap file.

A symbol

The symbol must have been previously registered by means of a call to `register-image-translation`.

An image object

As returned by `load-image`.

An image locator object

Allowing a single bitmap to be created which contains several button images side by side. See `make-image-locator` for more information. On Microsoft Windows, this also allows access to bitmaps stored as resources in a DLL.

An integer

This is a zero-based index into the list view’s image list. This is generally only useful if the image list is created explicitly. See `image-list` for more details.
The state-image-function is called on an item to determine the state image, an additional optional image used to indicate the state of an item. It can return one of the above, or nil to indicate that there is no state image. State images may be used in any view, but are typically used in the report and list views.

If image-lists is supplied, it should be a plist containing the following keywords as keys. The corresponding values should be image-list objects.

: normal  
  Specifies an image-list object that contains the large item images. The image-function should return a numeric index into this image-list.

: small  
  Specifies an image-list object that contains the small item images. The image-function should return a numeric index into this image-list.

: state  
  Specifies an image-list object that contains the state images. The state-image-function should return a numeric index into this image-list.

If both the large icon view (icon view) and one or more of the small icon views (small icon view, list view, report view) are to be used, special considerations apply.

The image lists must be created explicitly, using the :image-lists initarg, and the image-function must return an integer. Take care to ensure that corresponding images in the :normal and :small image lists have the same numeric index.

Returning pathnames, strings or image-locators from the image function cause the CAPI to create the image-lists automatically; however, if large and small icon views are mixed, this will lead to incorrect icons (or no icons) being displayed in one or other view.
Notes

1. list-view is not implemented on Cocoa.

2. For some applications multi-column-list-panel will suffice instead of list-view.

See also

image-list
list-panel
make-image-locator
multi-column-list-panel
“image-list, image-set and image-locator” on page 64
“Working with images” on page 219

listener-pane

Package capi

Superclasses interactive-pane

Description A listener pane is an editor pane that accepts Lisp forms, entered by the user at a prompt, which it then evaluates. All of the output that is sent to *standard-output* is sent to the listener, and finally the results of the evaluation are displayed.

Example

(capi:contain (make-instance 'capi:listener-pane)
 :best-width 300 :best-height 200)

See also collector-pane
interactive-pane
“Stream panes” on page 30

listener-pane-insert-value

Function

Summary Evaluates a form and inserts the result in a listener-pane.
Signature

Listener-pane-insert-value pane form

Arguments

pane A listener-pane.
form A Lisp form.

Description

The function listener-pane-insert-value evaluates the form form and inserts the result in the listener-pane pane, as if it resulted from user input. The result is printed, and the values of the history variables *, **, ***, /, ///, and //// are set.

listener-pane-insert-value may be called in any process.

Multiple values in the result of evaluating form are not supported: the first value only is inserted in pane.

See also

interactive-pane-execute-command

load-cursor

Function

Summary

Loads a cursor.

Package
capi

Signature

Load-cursor filename-or-list => cursor

Arguments

filename-or-list A string or a list.

Values

cursor A cursor object.

Description

The function load-cursor loads a cursor from your cursor file, or loads a built-in cursor. It returns a cursor object which can be supplied as the value of the simple-pane :cursor initarg.
The cursor object can also be set with `(setf simple-pane-cursor)` to change a pane’s cursor. This must be done in the process of the pane’s interface.

If `filename-or-list` is a string, then it names a file which should be in a suitable format for the platform, as follows:

Microsoft Windows

.\cur or .\ani format.

Cocoa

TIFF format.

GTK+

Any image format that `load-image` supports.

Note: The image can be of any dimension, but it will be clipped to what the server thinks is an appropriate size, 32x32 or 16x16. Using large images would waste space, because the image would still be in memory.

The file is loaded at the time `load-cursor` is called, so the cursor object does not require the file at the time the cursor is displayed. The cursor object survives saving and delivering the image.

If `filename-or-list` is a list then it names a file or a built-in cursor to be loaded for a particular library, optionally together with arguments to be passed to the library. It should be of the form:

```
((libname_1 filename_1 arg_1a arg_1b ...)                  
  (libname_2 filename_2 arg_2a arg_2b ...)                 
  ...                                                       
)
```

where `libname_n` is a keyword naming a supported library such as `:cocoa`, `:win32` or `:gtk` (see `default-library` for the values) and `filename_n` is either a string naming the cursor file to load for this library or a keyword naming one of the built-in cursors. `arg_n_a`, `arg_n_b` and so on are library-specific arguments. Currently these are not used on Microsoft Windows. Hotspot keyword arguments `:x-hot` and `:y-hot` are
supported on Cocoa and GTK+ as in the example below. They specify the hotspot of the cursor. The values must be integers inside the image dimensions, that is they satisfy:

\[
\text{(and (> image-width x-hot -1)} \\
\text{ (> image-height y-hot -1))}
\]

On GTK+ the library-specific arguments also include the keywords :transparent-color-index and :type, which are passed to \text{read-external-image}. Note that supplying the \text{transparent-color-index} allows making a useful cursor with a simple format image file which does not have transparency.

Example

This example loads a standard Microsoft Windows cursor file:

\[(setq cur1 (capi:load-cursor "arrow_l"))\]

This example loads a standard Windows cursor file, and on Motif uses one of the built-in cursors:

\[(setq cur2 \\
\text{(capi:load-cursor '((:win32 "3dwns")} \\
\text{ (:motif :v-double-arrow))}))\]

This example loads a horizontal double-arrow on Windows, and a vertical double-arrow on Motif:

\[(setq cur3 \\
\text{(capi:load-cursor '((:win32 :h-double-arrow)} \\
\text{ (:motif :v-double-arrow))}))\]

This example loads a custom .cur file:

\[(setq cur4 \\
\text{(capi:load-cursor} \\
\text{"C:/Temp/Animated_Cursors/1a.cur")})\]

In this extended example, firstly we load a custom cursor for two platforms:
(setq cur
  (capi:load-cursor
   '(((win32
       "c:/WINNT40/Cursors/O_CROSS.CUR")
     (:cocoa
       "/Applications/iPhoto.app/Contents/Resources/retouch-cursor.tif"
       :x-hot 2
       :y-hot 2))))

Now we display a pane with the custom cursor loaded above:

(setq oo
  (capi:contain
   (make-instance
    'capi:output-pane
     :cursor cur
     :input-model
     `(((:button-1 :press)
        ,(lambda (&rest x)
          (print x)))))))

We can remove the custom cursor:

(capi:apply-in-pane-process oo
  (lambda ()
    (setf (capi:simple-pane-cursor oo)
      :default)))

And we can restore the custom cursor:

(capi:apply-in-pane-process oo
  (lambda ()
    (setf (capi:simple-pane-cursor oo)
      cur)))

See also simple-pane
load-sound

Function

Summary
Converts data to a loaded sound object on Microsoft Windows and Cocoa.

Package
capi

Signature
load-sound source &key owner => sound

Arguments
source A pathname designator or an array returned by read-sound-file.
owner A CAPI interface, or nil.

Values
sound An array of element type (unsigned-byte 8).

Description
The function load-sound converts source into a loaded sound which can be played by play-sound.

source can be a pathname designator or an array returned by read-sound-file.

owner should be a CAPI interface object, or nil which means that the sound’s owner is the current top level interface.

The loaded sound sound will be unloaded (freed) automatically when its owner is destroyed. To create a sound that is never unloaded, pass the screen as the argument owner.

Notes
1. The array sound contains the contents of the file. Its bytes are interpreted by the OS functions, so the format can be whatever they can deal with, for example WAV on Microsoft Windows. The fact that this date is represented as an (unsigned-byte 8) array in Lisp does not constrain the output size.
2. load-sound is not implemented on GTK+ and Motif.

605
locate-interface

Generic Function

Summary
Finds an interface of a given class that matches supplied initargs.

Package
capi

Signature
locate-interface class-spec &rest initargs
&key screen no-busy-interface
&allow-other-keys => interface

Arguments
class-spec A specifier for a subclass of interface.
initargs Initialization arguments for class-spec.
screen A screen or nil.
no-busy-interface A boolean, defaulting to nil.

Values
interface An interface of class class-spec, or nil.

Description
The generic function locate-interface finds an interface of the class specified by class-spec that matches initargs and screen.

First, locate-interface finds all interfaces of the class specified by class-spec by calling collect-interfaces with class-spec and screen. The first of these which match initargs (by interface-match-p) is returned.
If there is no match, then `locate-interface` finds the first of these which can be reused for `initargs`, by `interface-reuse-p`. This reusable interface is reinitialized by `reinitialize-interface` and returned.

`no-busy-interface` controls the use of the busy cursor during reinitializing of a reusable interface. If `no-busy-interface` is `nil`, then this interface has the busy cursor during reinitialization. If `no-busy-interface` is true, then there is no busy cursor.

If no matching or reusable interface is found, or if global interface re-use is disabled by `(setf reuse-interfaces-p)`, then `locate-interface` returns `nil`.

See also
- `collect-interfaces`
- `interface-match-p`
- `interface-reuse-p`
- `reuse-interfaces-p`

### lower-interface

**Function**

**Summary** Pushes a window to the back of the screen.

**Package** `capi`

**Signature** `lower-interface pane`

**Description** The function `lower-interface` pushes the window containing `pane` to the back of the screen.

To raise the window use `raise-interface`, and to iconify it use `hide-interface`.

See also
- `hide-interface`
- `interface`
- `raise-interface`
- `quit-interface`

“Manipulating top-level windows” on page 105
**make-container**

*Generic Function*

**Summary**
The generic function `make-container` creates a container for a specified element.

**Package**
capi

**Signature**
`make-container element &rest interface-args`

**Description**
This creates a container for `element` such that calling `display` on it will produce a window containing `element` on the screen. It will produce a container for any of the following classes of object:

- `simple-pane`
- `layout`
- `interface`
- `pinboard-object`
- `menu`
- `menu-item`
- `menu-component`
- `list`

In the case of a `list`, the CAPI tries to see what sort of objects they are and makes an appropriate container. For instance, if they were all simple panes it would put them into a column layout.

The arguments `interface-args` will be passed through to the `make-instance` of the top-level interface, assuming that pane is not a top-level interface itself.

The complementary function `contain` uses `make-container` to create a container for an element which it then displays.

**Example**
```
(capi:display (capi:make-container
  (make-instance
    'capi:text-input-pane)))
```
make-docking-layout-controller  Function

Package  capi

Signature  make-docking-layout-controller => controller

Values  controller  A docking layout controller.

Description  The function make-docking-layout-controller returns a docking layout controller object for use as the controller initarg in docking-layout.

Layouts which share a docking layout controller are known as a Docking Group. See docking-layout for information about Docking Groups.

See also  docking-layout

make-foreign-owned-interface  Function

Summary  Creates a dummy interface which allows another application’s window to be the owner of a CAPI dialog.

Package  capi

Signature  make-foreign-owned-interface &key handle name => interface

Arguments  handle  A Microsoft Windows hwnd.
name  A string naming interface.
Values

*interface*  
An instance of *foreign-owned-interface*.

Description

The function `make-foreign-owned-interface` creates an instance of *foreign-owned-interface*. *interface* can be used as the *owner* argument when displaying a dialog. For information about dialog owners, see Chapter 11, "Dialogs: Prompting for Input".

*handle* must be supplied and is the window handle (Windows hwnd) of a window in some application. For a CAPI window this window handle can be obtained by `simple-pane-handle`. For non-CAPI applications, the method of finding the window handle will depend on the language and the way windows are represented, so you should consult the appropriate documentation.

*name* becomes the name of *interface*, and has no other meaning.

`make-foreign-owned-interface` is implemented only on Microsoft Windows.

Example

This example shows how a CAPI window can be the owner of a dialog in another LispWorks image.

Start LispWorks for Windows.

1. In the Listener, do **Tools > Interface > Listen**. This puts the Listener interface in the value of *.

2. In the Listener enter `(capi:simple-pane-handle *)`. The returned value is the window handle, it should be an integer. Denote this value by *hwnd*.

Start another LispWorks for Windows image (do not quit the first image). In the Listener of this second LispWorks image:

1. Enter `(setq foi (capi:make-foreign-owned-interface :handle hwnd))`.

2. Enter `(capi:prompt-for-color "Color?" :owner foi)`.
Now note that the Color dialog is owned by the Listener of the first LispWorks image.

**make-general-image-set**

*Function*

**Summary**

Creates an image-set object.

**Package**

capi

**Signature**

make-general-image-set &key image-count width height id => image-set

**Arguments**

- `image-count`: An integer.
- `width`: An integer or nil.
- `height`: An integer or nil.
- `id`: A pathname, string or symbol.

**Values**

- `image-set`: An image-set object.

**Description**

The function **make-general-image-set** creates an image-set object that refers to an image or a file containing an image.

`id` is a pathname or string identifying an image file, or a symbol previously registered with register-image-translation.

`width` and `height` are the dimensions of a single sub-image within the main image, and `image-count` specifies the number of sub-images in the image.

**Examples**

(example-edit-file "capi/choice/tree-view")

(example-edit-file "capi/choice/extended-selection-tree-view")

(example-edit-file "capi/elements/toolbar")
See also

image-set
make-resource-image-set
“image-list, image-set and image-locator” on page 64

make-icon-resource-image-set
Function

Summary
Constructs an image set object identifying a icon resource in a Windows DLL.

Package
capi

Signature
make-icon-resource-image-set &key image-count width height library id => image-set

Arguments
image-count An integer.
width An integer.
height An integer.
library A string.
id A string or an integer.

Values
image-set An image-set object.

Description
The function make-icon-resource-image-set constructs an image set object that identifies an image stored as a icon resource in a DLL on Microsoft Windows.

width and height are the dimensions of a single sub-image within the main image, and image-count specifies the number of sub-images in the image.

library should be a string specifying the name of the DLL.
id should be either an integer which is the resource identifier of the icon, or a string naming the icon resource.
Notes  

make-icon-resource-image-set is only available in Lisp-Works for Windows.

See also  
image-set  
make-general-image-set  
“image-list, image-set and image-locator” on page 64

make-image-locator  

Function

Summary  Creates an image-locator object to use with toolbars, list views and tree views.

Package  capi

Signature  make-image-locator &key image-set index => image-locator

Arguments  

image-set  An image-set.

index  A non-negative integer.

Values  

image-locator  An image-locator.

Description  The function make-image-locator creates an image-locator object for use with toolbars, list views, and tree views. It is used to specify a single sub-image from a larger image that contains many images side by side. It is also useful for accessing some images that can only be specified by means of image sets.

See also  
image-set  
“image-list, image-set and image-locator” on page 64

make-menu-for-pane  

Function

Summary  Makes a menu or a menu-component for a pane.
| **Package** | capi |
| **Signature** | make-menu-for-pane pane items &key title menu-name component-p => menu |
| **Arguments** | pane A pane. |
| | items A list of menu-objects. |
| | title A string or nil. |
| | menu-name A string or nil. |
| | component-p A boolean. |
| **Values** | menu A menu or a menu-component. |
| **Description** | The function make-menu-for-pane makes a menu or a menu-component for the pane pane with the items specified by items. |
| | items should be a list in which each element is a menu-item, menu-component or menu. |
| | title and menu-name provide a title and name for menu. title and menu-name both default to nil. |
| | If component-p is true, then make-menu-for-pane creates a menu-component rather than a menu. The default value of component-p is nil. |
| | menu is set up so that by default each callback inside it is done on the pane pane itself. This is the useful feature of make-menu-for-pane because it avoids the need to set up items to do their callbacks on pane explicitly. |
| | Note that this is merely the default behavior. You can specify different callback behavior on a per-item basis, using setup-callback-argument and callback-data-function (see menu-object), callback-type (see callbacks) and data for menu-item (see item). |
See also  
make-pane-popup-menu
pane-popup-menu-items
“Popup menus for panes” on page 122

make-pane-popup-menu  
Generic Function

Summary  Generates a popup menu or menu-component.

Package  capi

Signature  
make-pane-popup-menu  pane  interface  &key  title  menu-name
component-p  =>  menu

Arguments  
pane  A pane in an interface.
interface  An interface or nil.
title  A string or nil.
menu-name  A string or nil.
component-p  A boolean.

Values  menu  A menu or a menu-component.

Description  The generic function make-pane-popup-menu generates a popup menu for pane.

interface can be nil if pane has already been created, in which case the interface of pane is used (obtained by the element accessor element-interface).

title and menu-name provide a title and name for menu. title and menu-name both default to nil.

If component-p is true, then make-pane-popup-menu creates a menu-component rather than a menu. The default value of component-p is nil.
Example

This code makes an interface with two graph-panes. The initialize-instance method uses make-pane-popup-menu to add a menu to the menu bar from which the user can perform operations on the graphs.

Note that, because make-pane-popup-menu calls make-menu-for-pane to make each menu, the callbacks in the menus are automatically done on the appropriate graph.

```lisp
(capi:define-interface gg () () (:panes (g1 capi:graph-pane) (g2 capi:graph-pane)) (:layouts (main-layout capi:column-layout '(g1 g2))) (:menu-bar) (:default-initargs :visible-min-width 200 :visible-min-height 300))

(defmethod initialize-instance :after ((self gg) &key)
  (with-slots (g1 g2) self
    (setf (capi:interface-menu-bar-items self) (append (capi:interface-menu-bar-items self) (list (make-instance 'capi:menu :title "Graphs" :items (list (capi:make-pane-popup-menu g1 self :title "graph1")
               (capi:make-pane-popup-menu g2 self :title "graph2"))))))

  (capi:display (make-instance 'gg)))
```
See also  \textit{make-menu-for-pane}  
“Popup menus for panes” on page 122

\textbf{make-resource-image-set}  \textit{Function}

\textbf{Summary}  Constructs an image set object identifying a bitmap resource in a Windows DLL.

\textbf{Package}  \textit{capi}

\textbf{Signature}  \texttt{make-resource-image-set \&key image-count width height library id \Rightarrow image-set}

\textbf{Arguments}  
- \textit{image-count}  An integer.
- \textit{width}  An integer.
- \textit{height}  An integer.
- \textit{library}  A string.
- \textit{id}  A string or an integer.

\textbf{Values}  \texttt{image-set}  An \texttt{image-set} object.

\textbf{Description}  The function \texttt{make-resource-image-set} constructs an image set object that identifies an image stored as a bitmap resource in a DLL on Microsoft Windows.  
\textit{width} and \textit{height} are the dimensions of a single sub-image within the main image, and \textit{image-count} specifies the number of sub-images in the image.  
\textit{library} should be a string specifying the name of the DLL.  
\textit{id} should be either an integer which is the resource identifier of the bitmap, or a string naming the bitmap resource.

\textbf{Notes}  \texttt{make-resource-image-set} is only available in LispWorks for Windows.
See also

image-set
make-icon-resource-image-set
make-general-image-set
“image-list, image-set and image-locator” on page 64

make-scaled-general-image-set

Summary
Constructs an image set object which scales images in another image set on Microsoft Windows.

Package
capi

Signature
make-scaled-general-image-set &key width height id image-count => image-set

Arguments
width An integer.
height An integer.
id A pathname, string or symbol.
image-count An integer.

Values
image-set An image-set object.

Description
The function make-scaled-general-image-set constructs an image set that provides scaled images based on an image-set object constructed from id as if by make-general-image-set.

width and height are the dimensions of a single sub-image within the main image, and image-count specifies the number of sub-images in both images. That is, the sub-images are scaled to this size.

The default value of image-count is 1.

Notes
make-scaled-general-image-set is only available in Lisp-Works for Windows.
See also  
image-set
make-general-image-set
“image-list, image-set and image-locator” on page 64

make-scaled-image-set  

Function

Summary  
Creates an image set by scaling the images of another image set on Microsoft Windows.

Package  
capi

Signature  
make-scaled-image-set &key image-count width height base-image-set => image-set

Arguments  
image-count  An integer.
width  An integer.
height  An integer.
base-image-set  An image-set object.

Values  
image-set  An image-set object.

Description  
The function make-scaled-image-set constructs an image set that provides scaled images based on an existing image set object base-image-set.

width and height are the dimensions of a single sub-image within the main image. That is, the sub-images in base-image-set are scaled to this size to produce the sub-images of image-set.

image-count specifies the number of sub-images in the image. It is unspecified what happens if image-count is different from the image count in base-image-set.

Notes  
make-scaled-image-set is only available in LispWorks for Windows.
See also  
image-set  
make-general-image-set  
“image-list, image-set and image-locator” on page 64

make-sorting-description  

Function

Summary  Makes a sorting description suitable for use in a sorted-object.

Package  capi

Signature  make-sorting-description &key type key sort reverse-sort sort-function object-sort-caller => sorting-description

Arguments  

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>A Lisp object naming the type of sorting.</td>
</tr>
<tr>
<td>key</td>
<td>A function of 1 argument.</td>
</tr>
<tr>
<td>sort</td>
<td>A function of 2 arguments.</td>
</tr>
<tr>
<td>reverse-sort</td>
<td>A function of 2 arguments.</td>
</tr>
<tr>
<td>sort-function</td>
<td>A sorting function.</td>
</tr>
<tr>
<td>object-sort-caller</td>
<td>A function of 5 arguments.</td>
</tr>
</tbody>
</table>

Description

The function make-sorting-description makes a sorting description object that can be used as one of the sort-descriptions in a sorted-object such as a list-panel.

type is a name that should be unique (compared by cl:equalp) amongst the sort-descriptions of a sorted-object.

key is a function that is passed to sort-function as its :key argument. The default value of key is cl:identity.

sort is a predicate function that is passed to sort-function to compare pairs of items.
reverse-sort is a predicate function that is passed to sort-function for reverse sorting.

Unless object-sort-caller is supplied, sort-function is the function that is called to actually do the sorting. Its signature is:

\[
\text{sort-function} \ items \ \text{predicate} \ \&\text{key} \ key
\]

The default value of sort-function is cl:sort.

When object-sort-caller is supplied, then it is called instead of calling the sort-function, and is responsible for the sorting. The signature of the caller is:

\[
\text{object-sort-caller} \ \text{sorted-object} \ items \ \text{sort-function} \ \text{sort} \ \text{sort-key} \Rightarrow \ \text{sorted-items}
\]

where sorted-object is the sorted-object itself, items is the list of items to sort, and sort-function, sort and key are taken from the description. sort is either the sort or reverse-sort as appropriate. The caller needs to return a sorted list of the items.

The caller can do the default behavior by:

\[
\text{funcall} \ \text{sort-function} \ item \ \text{sort} :\text{key} \ key
\]

Notes

1. The purpose of using object-sort-caller is to allow access to the sorted-object to decide how to do the sorting. When using object-sort-caller, the sort-function, sort, reverse-sort and key are used solely as arguments to it, hence in this case you can supply arbitrary values which the caller interprets.

2. The sorting can be destructive
Example

```
(setq lp
  (capi:contain
    (make-instance
      'capi:list-panel
        :items '("Apple"
          "Orange"
          "Mangosteen"
          "Pineapple")
        :visible-min-height '(:character 5)
        :sort-descriptions
          (list (capi:make-sorting-description
              :type :length
              :sort
                #'(lambda (x y)
                (if (> (length x) (length y))
                  :reverse-sort
                #'(lambda (x y)
                (< (length x) (length y)))))
              (capi:make-sorting-description
                :type :alphabetic
                :sort 'string-greaterp
                :reverse-sort 'string-lessp))))))

(capi:sorted-object-sort-by lp :length)
(capi:sorted-object-sort-by lp :alphabetic)
```

See also

- sort-object-items-by
- sorted-object
- sorted-object-sort-by

### manipulate-pinboard

**Generic Function**

**Summary**

Adds or removes one or more pinboard-objects on a pinboard.

**Package**

capi

**Signature**

`manipulate-pinboard pinboard-layout pinboard-object action &key position`

**Arguments**

pinboard-object

A pinboard-object to be added, or (with action :add-many) a list of pinboard-objects to be added.

With action :delete-if, pinboard-object can also be a function of one argument, for multiple deletion.

action


position

One of :top or :bottom, or a non-negative integer.

Description

The generic function manipulate-pinboard adds pinboard-object to pinboard-layout, or removes one or more pinboard-objects from pinboard-layout. These operations can also be effected using (setf layout-description), but manipulate-pinboard is much more efficient and produces a better display.

If action is :add, then the pinboard-object pinboard-object is added according to the value of position:

:top On top of the other pinboard objects.

:bottom Below the other pinboard objects.

An integer At index position in the sequence of pinboard objects, where 0 is the index of the topmost pinboard object. Values of position greater than the number of pinboard objects are interpreted as :bottom.

action :add-top is the same as passing action :add and position :top.

action :add-bottom is the same as passing action :add and position :bottom.
**action**: `:add-many` is like calling the function with `:add` several times, but is more efficient. The value of `pinboard-object` must be a list of `pinboard-objects`, each of which is added at the specified `position`, as for `:add`.

**action**: `:delete` deletes the `pinboard-object` from `pinboard-layout`.

When **action** is `:delete-if`, `pinboard-object` should be a function which takes one argument, a `pinboard-object`. This function is applied to each `pinboard-object` in `pinboard-layout` and each object for which it returns true is deleted from `pinboard-layout`.

**Notes**
You can control automatic resizing of `pinboard-object` using `set-object-automatic-resize`.

**Example**

```lisp
(setq pl
  (capi:contain
   (make-instance 'capi:pinboard-layout
     :visible-min-height 500
     :visible-min-width 200)))

Add some `pinboard-objects`:

(capi:apply-in-pane-process
 pl #'(lambda (pp)
    (dotimes (y 10)
      (let ((yy (* y 40)))
        (capi:manipulate-pinboard pp
         (make-instance 'capi:line-pinboard-object
          :start-x 4 :start-y yy
          :end-x 54 :end-y (+ 6 yy))
          :add-top)
        (capi:manipulate-pinboard pp
          (make-instance 'capi:pinboard-object
            :x 4 :y (+ 20 yy)
            :width 50 :height 6
            :graphics-args
            '!(:background :red))
            :add-top)))))
pl)
```
Remove some pinboard-objects:

(capi:apply-in-pane-process pl
  #'(lambda (pp)
      (dotimes (y 15)
        (let ((po (capi:pinboard-object-at-position pp 10 (* y 30))))
          (when po (capi:manipulate-pinboard pp po :delete)))))))
pl)

Remove all line-pinboard-objects:

(capi:apply-in-pane-process pl 'capi:manipulate-pinboard pl
  #'(lambda (x)
      (typep x 'capi:line-pinboard-object)
      :delete-if))

See also pinboard-layout
set-object-automatic-resize

map-collection-items

Generic Function

Summary The generic function map-collection-items calls a specified function on all the items in a collection.

Package capi

Signature map-collection-items collection function &optional collect-results-p

Arguments collection A collection.

function A function designator for a function of one argument.

collect-results-p A generalized boolean.
Description  Calls function on each item in the collection by calling the collection's items-map-function. If collect-results-p is true, the results of these calls are returned in a list.

Example  
(setq collection (make-instance 'capi:collection :items '(1 2 3 4 5)))
(capi:map-collection-items collection 'princ-to-string t)

See also  collection choice

map-pane-children  
Generic Function

Summary  Calls a function on each of a pane's children.

Package  capi

Signature  map-pane-children pane function &key visible test reverse

Arguments  pane  A CAPI pane.
function  A function of one argument.
visible  A boolean. The default value is nil.
test  A function of one argument, or nil. The default is nil.
reverse  A boolean. The default value is nil.

Description  The function map-pane-children applies function to pane's immediate children.

If visible is true, then function is applied only to the visible children.

If test is non-nil, it is a function which is applied first to each child, and only those for which test returns a true value are then passed to function.
If `reverse` is non-nil, the order in which the children are processed is reversed.

**Example**

This example constructs a pinboard containing random ellipses. A repaint function is mapped over them, restricted to those with width greater than height.
(defun random-color ()
  (aref #!(:red :blue :green :yellow :cyan
         :magenta :pink :purple :black :white)
       (random 10)))

(defun random-origin ()
  (list (random 350) (random 250)))

(defun random-size ()
  (list (+ 10 (random 40))
        (+ 10 (random 40))))

(setf ellipses
  (capi:contain
    (make-instance
      'capi:pinboard-layout
      :children
    (loop for i below 40
        for origin = (random-origin)
        for size = (random-size)
        collect
      (make-instance 'capi:ellipse
        :x (first origin)
        :y (second origin)
        :width (first size)
        :height (second size)
        :graphics-args
        (list :foreground
          (random-color))
        :filled t)))))

(defun repaint (ellipse)
  (setf (capi:pinboard-object-graphics-args ellipse)
        (list :foreground (random-color)))
  (capi:redraw-pinboard-object ellipse t))

(defun widep (ellipse)
  (capi:with-geometry ellipse
    (> capi:%width% capi:%height%)))

(capi:map-pane-children ellipses 'repaint :test 'widep)

See also

map-pane-descendant-children

"Hierarchy of panes" on page 27
map-pane-descendant-children

Generic Function

Summary
Calls a function on each of the descendant panes of a pane.

Package
capi

Signature
map-pane-descendant-children pane function &key visible test reverse leaf-only

Arguments
- **pane**: A CAPI pane.
- **function**: A function of one argument.
- **visible**: A boolean. The default value is nil.
- **test**: A function of one argument, or nil. The default is nil.
- **reverse**: A boolean. The default value is nil.
- **leaf-only**: A generalized boolean. The default value is nil.

Description
The function map-pane-descendant-children applies function to pane’s descendant panes (that is, the children and each of their children recursively), depth first.

If **visible** is true, then function is applied only to the visible descendant panes.

If **test** is non-nil, it is a function which is applied first to each descendant pane, and only those for which test returns a true value are then passed to function.

If **reverse** is non-nil, the order in which the children are processed is reversed.

If **leaf-only** is true, then function is applied only to those panes which do not have children.

See also
- map-pane-children
- pane-descendant-child-with-focus
- “Hierarchy of panes” on page 27
map-typeout  

Function

Package capi

Signature map-typeout pane &rest args

Description Makes a collector-pane the visible child of a switchable-layout, and returns it as well. The switchable layout is found by looking up the parent hierarchy starting from pane.

The switchable layout should have one or more children. If it has one child, a new collector pane is made using args as the initargs with buffer-name defaulting to "Background Output". If it has more than one, it searches through the children to find the first collector pane.

See also unmap-typeout  
with-random-typeout  
collector-pane

*maximum-moving-objects-to-track-edges*  

Variable

Summary Limits the tracking of edges in a graph.

Package capi

Initial Value 15

Description If there are more than *maximum-moving-objects-to-track-edges* objects being moved in a graph, then edges are not tracked.

The value should be an integer.

See also graph-pane
The class `menu` creates a menu for an interface when specified as part of the menu bar (or as a submenu of a menu on the menu bar). It can also be displayed as a context menu.

**Package**
capi

**Superclasses**
element
titled-menu-object

**Initargs**
- `:items` The items to appear in the menu.
- `:items-function` A function to dynamically compute the items.
- `:mnemonic` A character, integer or symbol specifying a mnemonic for the menu.
- `:mnemonic-escape` A character specifying the mnemonic escape. The default value is `#\&`.
- `:mnemonic-title` A string specifying the title and a mnemonic.
- `:image-function` A function providing images for the menu items, or `nil`.

**Accessors**
- menu-items
- menu-image-function

**Description**
A menu has a title, and has items appearing in it, where an item can be either a `menu-item`, a `menu-component` or another `menu`. 
The simplest way of providing items to a menu is to pass them as the argument `items`, but if you need to compute the items dynamically you should provide the setup callback `items-function`. This function should return a list of menu items for the new menu. By default `items-function` is called on the menu's interface, but a different argument can be specified using the `menu-object initarg setup-callback-argument`.

If an item is not of type `menu-object`, then it gets converted to a `menu-object` with the item as its data. This function is called before the `popup-callback` and the `enabled-function` which means that they can affect the new items.

To specify a mnemonic in the menu title, you can use the initarg `:mnemonic`. The value `mnemonic` can be:

- An integer: The index of the mnemonic in the title.
- A character: The mnemonic in the title.
- `nil`: A character is chosen from a list of common mnemonics, or the `:default` behavior is followed. This is the default.
- `:default`: A mnemonic is chosen using some rules.
- `:none`: The title has no mnemonic.

An alternative way to specify a mnemonic is to pass `mnemonic-title` (rather than `title`). This is a string which provides the text for the menu title and also specifies the mnemonic character. The mnemonic character is preceded in `mnemonic-title` by `mnemonic-escape`, and `mnemonic-escape` is removed from `mnemonic-title` before the text is displayed. For example:

`:mnemonic-title "&Open File..."`

At most one character can be specified as the mnemonic in `mnemonic-title`. To make `mnemonic-escape` itself appear in the button, precede it in `mnemonic-title` with `mnemonic-escape`. For example:
If `image-function` is non-nil, it should be a function of one argument. `image-function` is called with the data of each menu item and should return one of:

- **nil**
  No image is shown.

- **An image object**
  The menu displays this image.

- **An image id or external-image**
  The system converts the value to a temporary image for the menu item and frees it when it is no longer needed.

If `image-function` is `nil`, no items in the menu have images. This is the default value.

**Notes**

1. `items-function` is called before the menu is raised (in order to initialize accelerators) and in particular it may be called before the interface is created. Therefore `items-function`, if you supply it, should work at this early stage.

2. On Cocoa and GTK+, menu items can contain both images and strings, so the `print-function` should return the appropriate string or "" if no string is required. On Microsoft Windows and Motif, if there is an image then the string is ignored. You can test programmatically whether menus with images are supported with `pane-supports-menus-with-images`.

3. When debugging a menu, it may be useful to pop up a window containing a menu with the minimum of fuss. The function `contain` will do just that for you.

4. To display a menu as a context (right button) menu, use `display-popup-menu`, and to display a menu via a labelled button use `popup-menu-button`. 
5. You must not use a menu object in multiple different places in menu bar(s) at the same time. Supply distinct instances instead. The one exception is popup menus, which can be used repeatedly and in different places.

6. Microsoft Windows can hide mnemonics when the user is not using the keyboard. See “Mnemonics on Microsoft Windows” on page 14.

Example

```lisp
(capi:contain (make-instance 'capi:menu
    :title "Test"
    :items '(:red :green :blue)))

(capi:contain (make-instance 'capi:menu
    :title "Test"
    :items '(:red :green :blue)
    :print-function 'string-capitalize))

(capi:contain (make-instance 'capi:menu
    :title "Test"
    :items '(:red :green :blue)
    :print-function 'string-capitalize
    :callback #'(lambda (data interface)
      (capi:display-message "Pressed ~S" data))))
```

Here is an example showing how to add submenus to a menu:

```lisp
(setq submenu (make-instance 'capi:menu
    :title "Submenu...
    :items '(1 2 3)))

(capi:contain (make-instance 'capi:menu
    :title "Test"
    :items (list submenu)))
```

Here is an example showing how to use the `items-function`: 
Finally, some examples showing how to specify a mnemonic in a menu title:

(capi:contain (make-instance
  'capi:menu
  :title "Mnemonic Title"
  :mnemonic 1
  :items '(1 2 3)))

(capi:contain (make-instance
  'capi:menu
  :mnemonic-title "M&nemonic Title"
  :items '(1 2 3)))

(capi:contain (make-instance
  'capi:menu
  :mnemonic-title "M&e && You"
  :items '("Me" "You")))

This example shows how to make a menu with images:

(example-edit-file "capi/elements/menu-with-images")

There are further examples here:

(example-edit-file "capi/applications/"

See also
display-popup-menu
menu-component
menu-item
menu-object
ole-control-add-verbs
pane-supports-menus-with-images
popup-menu-button
“CAPI elements” on page 2
Chapter 8, “Creating Menus”
“Working with images” on page 219
The class `menu-component` is a choice that is used to group menu items and submenus both visually and functionally. The items contained by the `menu-component` appear separated from other items, menus, or menu components, by separators.

Package `capi`

Superclasses `choice` `titled-menu-object`

Initargs

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>:items</td>
<td>The items to appear in the menu.</td>
</tr>
<tr>
<td>:items-function</td>
<td>A setup callback function to dynamically compute the items.</td>
</tr>
<tr>
<td>:selection-function</td>
<td>A setup callback function to dynamically compute the selection.</td>
</tr>
<tr>
<td>:selected-item-function</td>
<td>A setup callback function to dynamically compute the selected item.</td>
</tr>
<tr>
<td>:selected-items-function</td>
<td>A setup callback function to dynamically compute the selected items.</td>
</tr>
</tbody>
</table>

Because `menu-component` is a choice, the component can have interaction `:no-selection`, `:single-selection` or `:multiple-selection` (extended selection does not apply here). This is represented visually in the menu as appropriate to the window system that the CAPI is running on (by ticks in Microsoft Windows, and by radio buttons and check buttons in Motif).
Note that it is not appropriate to have menu components or submenus inside `:single-selection` and `:multiple-selection` components, but it is OK in `:no-selection` components.

`items` and `items-function` behave as in `menu`.

No more than one of `selection-function`, `selected-item-function` and `selected-items-function` should be non-nil. Each defaults to nil. If one of these setup callbacks is supplied, it should be a function which is called before the `menu-component` is displayed and which determines which items are selected. By default the setup callback is called on the interface of the `menu-component`, but this argument can be changed by passing the `menu-object initarg setup-callback-argument`.

`selection-function`, if non-nil, should return a value which is suitable for passing to the `choice accessor` (setf `choice-selection`). This will be nil, or a single index (for interaction `:single-selection`), or a list of item indices (for interaction `:multiple-selection` and `:extended-selection`).

`selected-item-function`, if non-nil, should return an object which is an item in the `menu-component`, or is equal to such an item when compared by the `menu-component`’s `test-function`.

`selected-items-function`, if non-nil, should return a list of such objects.

**Example**

```lisp
(capi:contain (make-instance
    'capi:menu-component
    :items '(:red :green :blue)
    :print-function 'string-capitalize
    :interaction :single-selection))

(capi:contain (make-instance
    'capi:menu-component
    :items '(:red :green :blue)
    :print-function 'string-capitalize
    :interaction :multiple-selection))
```
(capi:contain (make-instance 'capi:menu
   :items (list
   "An Item"
   (make-instance
      'capi:menu-component
      :items '(:red :green :blue)
      :print-function
      'string-capitalize
      :interaction :no-selection)
   "Another Item")))

See also menu
menu-item
"CAPI elements" on page 2
Chapter 5, “Choices - panes with items”
Chapter 8, “Creating Menus”

menu-item

Summary A menu item is an individual item in a menu or menu com-
ponent, and instances of menu-item are created automatically by define-interface.

Package capi

Superclasses item
titled-menu-object

Initargs :accelerator
A character, string or plist, or the keyword :default.

:alternative
A generalized boolean.

:help-key
An object used for lookup of help. Default value t.
:mnemonic  A character, integer or symbol specifying a mnemonic for the menu item.

:mnemonic-escape  A character specifying the mnemonic escape. The default value is #\&.

:mnemonic-title  A string specifying the text and a mnemonic.

:selected-function  A setup callback determining whether the item is selected.

:enabled-function-for-dialog  nil, t, :same-as-normal or a function designator. Determines enabled state when a dialog is on screen.

Readers  help-key

Description  The text displayed in the menu item is the contents of the text slot, or the contents of the title slot, otherwise it is the result of applying the print-function to the data.

If selected-function is non-nil it should a function which is called before the menu-item is displayed and which determines whether or not the menu-item is selected. By default selected-function is called on the interface of the menu-item, but this argument can be changed by passing the menu-object initarg setup-callback-argument. The default value of selected-function is nil.

Callbacks are made in response to a user gesture on a menu-item. The callback-type (see callbacks), callback and callback-data-function (see menu-object) are found by looking for a non-nil value, first in the menu-item, then the menu-component (if any) and finally the menu. This allows a whole
menu to have, for example, \textit{callback-type} :\texttt{data} without having to specify this in each item. Some items could over-ride this by having their \textit{callback-type} slot non-nil if needed.

To specify a mnemonic in the menu item, you can use the initarg :\texttt{mnemonic}, or the initargs :\texttt{mnemonic-title} and :\texttt{mnemonic-escape}. These initargs are all interpreted just as in \texttt{menu}.

A menu item should not be used more in more than one place at a time.

\texttt{help-key} is interpreted as described for \texttt{element}.

\texttt{accelerator} can be a character or string specifying a key gesture which will be the accelerator for the menu item.

Note that \texttt{both-case-p} characters are not allowed with the single modifier \texttt{Shift} in the accelerator argument. So instead of

\begin{verbatim}
 :accelerator "shift-x"
\end{verbatim}

use

\begin{verbatim}
 :accelerator "X"
\end{verbatim}

Note that the \texttt{Shift} modifier still appears in the menu.

A \texttt{both-case-p} character is allowed with \texttt{Shift} if there are other modifiers, for example

\begin{verbatim}
 :accelerator "alt-shift-x"
\end{verbatim}

If \texttt{accelerator} is a \texttt{character} then the system adds the normal modifier for the platform. That is, \texttt{Command} on Cocoa and \texttt{Control} on Microsoft Windows. The shortcut is validated for the platform.

If \texttt{accelerator} is a \texttt{string} with modifier keys then the system uses it only if it follows the normal conventions for the platform. The shortcut is validated for the platform.
The special virtual modifier name "accelerator" is allowed in string values of `accelerator`. It is interpreted as the normal modifier key for the platform. For example:

`:accelerator "accelerator-x"`

means `Control+X` on Microsoft Windows and Motif, and `Command+X` on Cocoa.

If `accelerator` is a plist then its keys are keywords naming some or all of the supported libraries (as returned by `default-library`). The plist’s values are characters or strings which the system interprets as above, except that no check is made that the keyboard shortcut is valid for the platform.

`accelerator` has a special default value `:default`, which means that, depending on `interface-keys-style` for the interface, a standard accelerator is added if the item title matches a standard menu command. For the full set of standard accelerators see “Standard default accelerators” on page 119.

**Note:** `accelerator` is not supported when the `menu-item` is in the `pane-menu` of a `simple-pane`.

`alternative`, when true, makes the `menu-item` an "alternative item". Alternative items are invoked if modifiers are held while selecting the "main item". These modifiers are defined by the item’s `accelerator`. The main item is the one before the first alternative item, and each alternative item must be within the same menu and menu component. For an example see:

`(example-edit-file "capi/elements/accelerators")`

and for more information see “Alternative menu items” on page 119.

`enabled-function-for-dialog` determines whether the item is enabled when a dialog is on the screen. Items in the menu bar menus and sub-menus are disabled by default while a dialog
is on the screen on top of the active window. You can over-
ride this by specifying \textit{enabled-function-for-dialog}. The value
can be one of:

\textbf{t} \quad \text{The item is enabled whenever there is a dia-
log.}
\textbf{nil} \quad \text{The item is disabled whenever there is a dia-
log.}
\textbf{:same-as-normal} \quad \text{Do the same as when there is no dialog. This}
\text{depends on the \textit{enabled-function} (see \texttt{menu-object}).}

\text{A function} \quad \text{A function that is called instead of the}
\textit{enabled-function} to decide if the item should
\text{be enabled. It is called with one argument,}
\text{by the default the menu interface, which can}
\text{be overridden by the initarg :setup-call-
back-argument} (see \texttt{menu-object} for
details).

The default value of \textit{enabled-function-for-dialog} is \texttt{nil}.

\textbf{Notes} \quad \text{Some accelerators do not work on some platforms because}
\text{they have other standard meanings, for example on}
\text{Microsoft Windows \texttt{F1} always invokes the \textit{help-callback}.}

\text{On X11/Motif the accelerators of alternative items do not}
\text{work.}

\textbf{Example} \quad \text{(capi:contain (make-instance 'capi:menu-item
\quad :text "Press Me"))}

\text{(capi:contain (make-instance 'capi:menu-item
\quad :data :red
\quad :print-function
\quad 'string-capitalize))}
In this example note how the **File** menu gets accelerators automatically for its standard items:

```lisp
(defun do-menu-item (item)
  (capi:display-message
   (format nil "~A" (capi:item-data item))))
```

(capi:define-interface mmm () ()
 (:menu-bar f-menu a-menu)
 (:menus
  (f-menu
   "File"
   ("Open..." :data "Open...")
   ("New"   :data "New"))
  :callback 'do-menu-item
  :callback-type :item)
 (a-menu
  "Another Menu"
  ("Open..." :data "Another Open")
  ("New"   :data "Another New")
  ("Blancmange" :data "Blancmange"
                 :accelerator "accelerator-b")
  :callback 'do-menu-item
  :callback-type :item))
 (:default-initargs
  :width 300
  :height 200))

;; This causes automatic accelerators on all platforms.

;; That is the default behavior on Microsoft Windows.
(defmethod capi:interface-keys-style ((self mmm)) :pc)

(capi:contain (make-instance 'mmm))

These are further examples:
See also
choice
interface-keys-style
menu
menu-component
“CAPI elements” on page 2
“Tooltips” on page 35
Chapter 8, “Creating Menus”
“Sharing toolbar callbacks with menu items” on page 130

menu-object

Class

Summary
The class menu-object is the superclass of all menu objects, and provides functionality for handling generic aspects of menus, menu components and menu items.

Package
capi

Superclasses
callbacks

Subclasses
titled-menu-object

Initargs
:popup-callback
Callback before the menu appears.

:enabled-function
Returns true if the menu is enabled.

:enabled-slot The object is enabled if the slot is non-nil.

:callback The selection callback for the object.

:callback-data-function
A function to return data for the callback.
:setup-callback-argument

If non-nil, specifies the argument to the setup callbacks (listed below) that are used to set up the menu-object.

:title

The title for the object.

:title-function

A setup callback which returns the title for the object, and optionally a mnemonic for the title.

Accessors

menu-popup-callback
menu-title
menu-title-function

Readers

menu-object-enabled

Description

The simplest way to give a title to a menu-object is to just supply a title string, and this will then appear as the title of the object.

Alternatively, a title-function can be provided which will be called when the menu is about to appear and which should return the title to use. By default title-function is called on the interface of the menu-object, but this argument can be changed by passing the initarg setup-callback-argument.

To specify a mnemonic in the title returned by title-function, make title-function return the mnemonic as a second value. This value is interpreted in the same way as the mnemonic argument for menu.

When the menu object is about to appear on the screen, the CAPI does the following:

1. The setup callback items-function (if there is one) is called and the result is used to set the items, for menu and menu-component. The argument passed to items-function is the same as for the other setup callbacks (see below).
2. The `popup-callback` (if there is one) is called and can make arbitrary changes to that object. The `popup-callback` is always called with the menu object, regardless of the value of `setup-callback-argument`.

3. The other setup callbacks are called to set up the selection, enabled state and title. These setup callbacks include `enabled-function` for all `menu-objects` and `title-function` for all `titled-menu-objects`. The additional setup callbacks for `menu-component` are `selection-function`, `selected-item-function`, and `selected-items-function`. `menu-item` has the additional setup callback `selected-function`.

By default `setup-callback-argument` is `nil`, which means that each of the setup callbacks is called on the interface of the `menu-object`. If `setup-callback-argument` is non-nil, then it is passed (instead of the interface) as the argument to each of the setup callbacks.

4. The menu containing the object appears with all of the changes made.

Note that `enabled-slot` is a short-hand means of creating an `enabled-function` which checks the value of a slot in the menu object’s interface.

The enabled state of a `menu-object` is computed each time the menu is displayed, using `enabled-function` or `enabled-slot`. Therefore the accessor `menu-object-enabled` is only useful as a reader.

The `callback` argument is placed in the `selection-callback`, `extend-callback` and `retract-callback` slots unless these are given explicitly, and so will get called when the menu object is selected or deselected.

The `callback-data-function` is a function that is called with no arguments and the value it returns is used as the data to the callbacks.
Notes

1. The function enabled-function should not display a dialog or do anything that may cause the system to hang. In general this means interacting with anything outside the Lisp image, including files, databases and so on.

2. The subclass titled-menu-object is retained only for backward compatibility.

Example

```lisp
(capi:contain (make-instance 'capi:menu-item
  :text "Press Me"
  :enabled-function #'(lambda (item)
    (eq (random 2)
    1)))))
```

The next example illustrates the use of setup-callback-argument. The initialize-instance method adds to the “Some Numbers” menu a sub-menu that lists the selected items in the list-panel. By using setup-callback-argument in this menu, the setup callbacks (in this case enabled-function and items-function) are called directly on the list-panel.

Note that, while this example uses a CAPI object as the setup-callback-argument, any object of any type can be used.
(capi:define-interface my-interface ()
 ()
 (:panes
  (list-panel
   capi:list-panel
   :items '(1 2 3 4 5 6 7 8 9 0)
   :interaction :extended-selection
   :visible-min-height '(character 10))
  (:menus
   (a-menu
    "Some Numbers"
   ("One" "Two")
  ))
  (:menu-bar a-menu))
)

(defmethod initialize-instance :after
 ((self my-interface) &key)
 (with-slots (a-menu list-panel) self
   (setf (capi:menu-items a-menu)
     (append
      (capi:menu-items a-menu)
      (list
       (make-instance 'capi:menu
         :items-function
         'capi:choice-selected-items
         :setup-callback-argument
         list-panel
         :enabled-function
         'capi:choice-selection
         :title
         "Selected Items")))))

(capi:display (make-instance 'my-interface))

See also

menu
menu-item
menu-component

merge-menu-bars

Generic Function

Summary

Computes the menu bar for a document-frame on Microsoft Windows.
Package: capi

Signature: merge-menu-bars frame document => menus

Arguments:
- frame: A document-frame.
- document: An interface or nil.

Values:
- menus: A list of menu objects.

Description:
The generic function `merge-menu-bars` is called by the system to compute the menu bar for a `document-frame` interface.

The set of visible menus in such an interface is typically made up from those of the frame and those of the active document within it.

There is a built-in unspecialized method that appends the menu bars of the two interfaces and is equivalent to this:

```
(defmethod capi:merge-menu-bars ((frame t) (document t))
  (append
    (capi:interface-menu-bar-items frame)
    (and document
      (capi:interface-menu-bar-items document))))
```

You can customize the menu bar by adding methods which specialize on particular frame and document interface classes.

Notes:
- `merge-menu-bars` is implemented only in LispWorks for Windows.

See also:
- `document-frame`
- `interface`
- `menu`
**message-pane**  
*Class*

**Summary**  
The class displaying the message when a pane is created with the `:message` initarg.

**Package**  
capi

**Superclasses**  
title-pane

**Description**  
The class *message-pane* is used to implement the message decoration on subclasses of *titled-object*.

A *message-pane* with text "Message" is created automatically when a *titled-object* is created with `message"Message"`.

**Notes**  
*message-pane* does not add functionality to *title-pane*, and it is used only to allow different resources in GTK+ and Motif.

**See also**  
titled-object

---

**metafile-port**  
*Class*

**Summary**  
A graphics port created by *with-external-metafile* and *with-internal-metafile*.

**Package**  
capi

**Superclasses**  
graphics-port-mixin

**Description**  
The class *metafile-port* is the graphics port that *with-external-metafile* and *with-internal-metafile* create when their *pane* argument is not supplied.

**See also**  
*with-external-metafile*  
*with-internal-metafile*
modify-editor-pane-buffer

Function

Summary
Modifies the contents and fill mode of a specified buffer.

Package
capi

Signature
modify-editor-pane-buffer pane &key contents flag fill fixed-fill force

Description
The function modify-editor-pane-buffer modifies the editor-pane pane according to the keyword arguments.

The argument contents (if non-nil) supplies a new string to place in the buffer.

If fill is non-nil the editor fills each paragraph in the buffer. If fill is a fixnum then the buffer is filled at that width. If fill is :default (the default value) and fixed-fill is supplied then the value fixed-fill is used. Otherwise the buffer is filled to the window width.

fixed-fill defaults to nil.

Notes
The argument flag is deprecated. You can supply the initarg :flag when creating an editor-pane.

See also
teditor-pane

modify-multi-column-list-panel-columns

Function

Summary
Modify the columns of a multi-column-list-panel.

Package
capi

Signature
modify-multi-column-list-panel-columns self &key columns x-adjust reorderable-columns sort-descriptions column-function item-print-functions

Arguments
self A multi-column-list-panel.
Description

The function `modify-multi-column-list-panel-columns` modifies the columns of `self`.

All the keyword arguments have the same meaning as the corresponding initargs in `multi-column-list-panel`. See the entry for `multi-column-list-panel` for details.

For all the keyword arguments, if they are not supplied the value does not change. For all keyword arguments except `sort-descriptions`, if they are passed as `nil` the corresponding value does not change. If `sort-descriptions` is passed as `nil`, the `sort-descriptions` are changed to `nil`.

Notes

1. The `columns` and the `column-function` need to match, so normally you modify them both. The new option to have `column-function` as a list of functions makes it easier to match, by just making `column-function` a list parallel to the `columns`.

2. An alternative solution is to use a `column-function` that decides dynamically what values to return based on some value that you set when you call `modify-multi-column-list-panel-columns`. For example you can make the `column-function` a function that closes over the containing interface, and check a slot in it to decide which columns to return, and then update this slot whenever you call `modify-multi-column-list-panel-columns`.

3. If `item-print-functions` is a list, it will also have to be updated when the `columns` are updated.

4. Since `sort-descriptions` are searched, they do not need to be updated when `columns` is updated, provided that they already contain all the sort kinds that any column may use.

See also `multi-column-list-panel`
**mono-screen**

*Class*

**Summary**
A class for monochrome screen.

**Package**
capi

**Superclasses**
screen

**Description**
This is a subclass of screen that gets created for monochrome screens. It is available primarily as a means of discriminating on whether or not to use colors in an interface.

**See also**
color-screen

**move-line**

*Generic Function*

**Summary**
Moves a line-pinboard-object.

**Package**
capi

**Signature**
move-line line-pinboard-object start-x start-y end-x end-y &key redisplay

**Arguments**
- line-pinboard-object
  - An instance of line-pinboard-object or a subclass.
- start-x
  - The x coordinate of the start of the line.
- start-y
  - The y coordinate of the start of the line.
- end-x
  - The x coordinate of the end of the line.
- end-y
  - The y coordinate of the end of the line.
- redisplay
  - A boolean.

**Description**
The generic function move-line moves a line to a new location with end points specified by the coordinate arguments.
This automatically adjusts the geometry of the object, taking into account other constraints. Examples of such constraints are the label in a labelled-line-pinboard-object and the arrowhead in a arrow-pinboard-object.

The default value of redisplay is t, which means that the changed line is redrawn immediately. If you are moving many objects at the same time, it is useful to pass :redisplay nil.

See also
line-pinboard-object
line-pinboard-object-coordinates

**multi-column-list-panel**

Class

Summary
A list panel with multiple columns of text.

Package
capi

Superclasses
list-panel

Initargs

:column-function
A function of one argument. The default is identity.

:item-print-functions
A function of one argument, or a list of such functions.

:columns
A list of column specifications.

:header-args
A plist of keywords and values.

:auto-reset-column-widths
A boolean. The default is t.

Description
The class multi-column-list-panel is a list panel which displays multiple columns of text. The columns can each have a title.
Note that this is a subclass of `list-panel`, and hence of `choice`, and inherits the behavior of those classes.

Each item in a `multi-column-list-panel` is displayed in a line of multiple objects. The corresponding objects of each line are aligned in a column.

The `column-function` generates the objects for each item. It should take an item as its single argument and return a list of objects to be displayed. The default `column-function` is `identity`, which works if each item is a list.

`column-function` can also be a list of function designators. In this case the length has to match the length of the `columns`. Each function is called with the item to generate the object for the corresponding column.

The `item-print-functions` argument determines how to calculate the text to display for each element. If `item-print-functions` is a single function, it is called on each object, and must return a string. Otherwise `item-print-functions` should be a sequence of length no less than than the number of columns. The text to display for each object is the result (again, a string) of calling the corresponding element of `item-print-functions` on that object.

The `columns` argument specifies the number of columns, and whether the columns have titles and callbacks on these titles.

Each element of `columns` is a specification for a column. Each column specification is a plist of keyword and values, where the allowed keywords are as follows:

- **:title** Specifies the title to use for the column. If any of the columns has a title, a header object is created which displays the titles. The values of the :title keywords are passed as the items of the header, unless header-args specifies :items.
:adjust  Specifies how to adjust the column. The value can be one of :right, :left, or :center.

;width  Specifies a fixed width of the column.

:default-width  Specifies the default initial width of the column. The user can resize it. If :width is supplied it overrides :default-width.

:visible-min-width  Minimum width of the column.

:gap  Specifies an additional gap alongside the text in the column. :gap is not supported consistently across platforms (see Notes below).

The values of :width, :visible-min-width and :gap are interpreted as standard geometric hints. See element for information about these hints.

columns should indicate how many columns to display. At a minimum the value needs to be (()()) for two columns without any titles

header-args is a plist of initargs passed to the header which displays the titles of the columns. The header object is a collection. The following collection initargs are useful to pass in header-args:

:selection-callback  A callback function for clicking on the header, or the keyword :sort which specifies sorting as described below.

:callback-type  Defines the arguments of the selection-callback.
:items The items of the header object, that is the titles. Note that :items overrides :title if that is supplied in columns.

:print-function Controls how each of items is printed, providing the title of each column.

header-args may also contain the keyword :alignments. The value should be a list of alignment keywords, each of which is interpreted like an :adjust value in columns. The alignment is applied to the title only.

When the callback is :sort, clicking on a header causes a call to sorted-object-sorted-by on the pane, with sort-type the title of the column, as given either by :items or :title in the columns. To make it work, you also need to define the sort-definitions, by making the pane with sort-descriptions with types that match the titles (see sorted-object and make-sorting-description).

If auto-reset-column-widths is true, then the widths of the columns are recomputed when the items of the multi-column-list-panel are set.

Notes

1. Similar and enhanced functionality is provided by list-view.

2. On Microsoft Windows, :width in a column specification does not actually make the column width be fixed, though it does supply the initial width.

3. On Microsoft Windows, :gap in a column specification adds the gap on both sides of the text. On Motif it adds the gap only on the right side of the text. On GTK+ and Cocoa :gap is ignored.

4. The number of columns in a multi-column-list-panel, their titles and what they show can be changed after the pane is displayed using modify-multi-column-list-panel-columns.
This example uses the `columns` initarg:

```lisp
(capi:contain
 (make-instance 'capi:multi-column-list-panel :visible-min-width 300 :visible-min-height :text-height :columns '(((:title "Fruits"
    :adjust :right
    :width (character 15))
   (:title "Vegetables"
    :adjust :left
    :visible-min-width (character 30)))
  :items '(("Apple" "Artichoke")
            ("Pomegranate" "Pumpkin")))

This example uses `header-args` to add callbacks and independent alignment on the titles:

```lisp
(defun mclp-header-callback (interface item)
  (declare (ignorable interface))
  (capi:display-message "Clicked on ~a" item))
```

```lisp
(capi:contain
 (make-instance 'capi:multi-column-list-panel :visible-min-width 300 :visible-min-height :text-height :columns '(((:adjust :right
    :width (character 15))
   (:adjust :left
    :visible-min-width (character 30)))
  :header-args '((:items ("Fruits" "Vegetables")
                    :selection-callback mclp-header-callback
                    :alignments (:left :right))
    :items '(("Apple" "Artichoke")
              ("Pomegranate" "Pumpkin"))))
```

This example file illustrates the use of the header’s `selection-callback` :sort to implement sorting of the columns:

```lisp
(example-edit-file "capi/choice/multi-column-list-panels")
```

This example uses `column-function` to implement a primitive process browser:
(defun get-process-elements (process)
  (list (mp:process-name process)
         (mp:process-whostate process)
         (mp:process-priority process)))

(capi:contain
 (make-instance
  'capi:multi-column-list-panel
   :visible-min-width '(character 70)
   :visible-min-height '(character 15)
   :items (mp:list-all-processes)
   :columns '((:title "Name" :adjust :left
                 :visible-min-width (character 30))
               (:title "State" :adjust :center
                 :visible-min-width (character 20))
               (:title "Priority" :adjust :center
                 :visible-min-width (character 12)))
   :column-function 'get-process-elements))

There are further examples in Chapter 20, “Self-contained examples”.

See also

- collection
- list-panel
- list-view
- make-sorting-description
- modify-multi-column-list-panel-columns
- sorted-object-sorted-by

“Multi-column list panels” on page 54

---

**multi-line-text-input-pane**

### Class

**Summary**

A pane allowing several lines of text to be entered.

**Package**

capi

**Superclasses**

text-input-pane
Description: The class `multi-line-text-input-pane` behaves like a `text-input-pane`, except that the text entered by the user is allowed to span several lines — that is, it is allowed to contain Newline characters.

See also: `text-input-pane`

“Displaying and entering text” on page 20

**non-focus-list-add-filter**

**non-focus-list-remove-filter**

**non-focus-list-toggle-filter**

**Functions**

Summary: Add or remove the filter in a non-focus list.

Signature:

- `non-focus-list-add-filter` `non-focus-list-interface`
- `non-focus-list-remove-filter` `non-focus-list-interface`
- `non-focus-list-toggle-filter` `non-focus-list-interface`

Arguments: `non-focus-interface`

A non-focus-list-interface.

Description: These functions add or remove the filter in a non-focus list.

- `non-focus-list-toggle-filter` calls `non-focus-list-add-filter` if the filter is off, otherwise it calls `non-focus-list-remove-filter` (it is used as the callback for the filtering-gesture).

- `non-focus-list-add-filter` adds a filter if it is not already on, resets the text in it to empty string, and enables it.

- `non-focus-list-remove-filter` removes the filter if it is on.

See also: `prompt-with-list-non-focus`
### non-focus-list-interface

**Class**

| Summary | Created (and destroyed) only by `prompt-with-list-non-focus` and `text-input-pane-in-place-complete`. |
| Superclasses | `interface` |
| Description | The class `non-focus-list-interface` is the class of interface created and destroyed only by `prompt-with-list-non-focus` and `text-input-pane-in-place-complete`. Do not instantiate this class directly. |
| See also | `prompt-with-list-non-focus`, `text-input-pane-in-place-complete` |

### non-focus-list-toggle-enable-filter

**Function**

| Summary | Toggles the enabled state of the filter. |
| Signature | `non-focus-list-toggle-enable-filter` `non-focus-list-interface` |
| Arguments | `non-focus-interface` |
| Description | A `non-focus-list-interface`. The function `non-focus-toggle-enable-filter` toggles the enabled state of the filter in a non-focus list created by `prompt-with-list-non-focus` or `text-input-pane-in-place-complete`. It has no effect if the filter is off. It is used as the callback of the `filtering-toggle`. |
| See also | `prompt-with-list-non-focus` |
**non-focus-maybe-capture-gesture**  
*Generic Function*

**Summary**  
Maybe capture a gesture by the non-focus-interface.

**Signature**  
\[\text{non-focus-maybe-capture-gesture} \to \text{result}\]  
\[\text{non-focus-interface} \text{ gesture} \Rightarrow \text{result}\]

**Arguments**  
- \(\text{non-focus-interface}\)  
  A \(\text{non-focus-list-interface}\).
- \(\text{gesture}\)  
  A gesture specifier.

**Values**  
- \(\text{result}\)  
  A generalized boolean.

**Method Signature**  
\[\text{non-focus-maybe-capture-gesture} (\text{non-focus-interface} \text{ non-focus-list-interface}) \text{ gesture}\]

**Description**  
The generic function \(\text{non-focus-maybe-capture-gesture}\) needs to return non-nil if the gesture \(\text{gesture}\) was captured, which means it should not be processed any more, or \(\text{nil}\) if \(\text{gesture}\) was not captured.

\(\text{gesture}\) should be a gesture specifier, which is an object that can be coerced to a Gesture Spec by \(\text{sys:coerce-to-gesture-spec}\).

The method on \(\text{non-focus-list-interface}\) does the following:

1. If the gesture is \text{Escape} it calls \(\text{non-focus-terminate}\) on the non-focus window.

2. It checks whether the gesture matches any of the gestures in the \(\text{gesture-callbacks}\) of the window. The gesture callbacks are either explicitly defined using the initargs \(\text{:gesture-callbacks}\) or \(\text{:add-gesture-callbacks}\), or implicitly. By default, all the gestures that are used in in-place completion (see “In-place completion” on page 168) are defined implicitly. These include \text{Up}, \text{Down}, \text{PageUp}, \text{PageDown} (selection in the list panel), \text{Return}
(action), Control+Return and Control+Shift+Return (control of the filter). The implicitly defined gestures are affected by gesture-callbacks, filtering-gesture and filtering-toggle.

If a match is found, it is invoked as described for gesture-callbacks in prompt-with-list-non-focus.

3. If filtering is enabled, it checks if the gesture is captured by the filter. A gesture is captured by the filter if it is:

   A plain graphic character.
   It is inserted to the filter
   
   Backspace
   The last character in the filter is deleted
   
   One of the gestures which update the state of the filter (by default Control+Shift+R, Control+Shift+E, Control+Shift+C)
   
   The state of the filter is updated.

   In any case, where a gesture is captured by the filter the list panel is updated.

   If the gesture is captured by one of the possibilities above, the method returns t, otherwise it returns nil.

See also

non-focus-terminate
prompt-with-list-non-focus

non-focus-terminate

Generic Function

Summary

Terminates the non-focus interface.

Signatures

non-focus-terminate non-focus-interface

Method Signature

non-focus-terminate (non-focus-interface non-focus-list-interface)
**Description**

The generic function `non-focus-terminate` closes the non-focus interface.

It has no return value.

The method terminates a `non-focus-list-interface`. It destroys the interface in the correct process.

**See also**

`prompt-with-list-non-focus`

---

**non-focus-update**

*Generic Function*

**Summary**

Updates the non-focus-interface.

**Signature**

`non-focus-update non-focus-interface`

**Method Signature**

`non-focus-update (non-focus-interface non-focus-list-interface)`

**Description**

The generic function `non-focus-update` updates the non-focus-interface.

It has no return value.

The method on `non-focus-list-interface` needs to be invoked in the process in which the `list-updater` that was passed to `prompt-with-list-non-focus` is expecting to run.

It invokes the `list-updater` without arguments, and then updates the non-focus-interface with result. See the description of `list-updater` in `prompt-with-list-non-focus`.

Note that if `list-updater` returns `:destroy`, this invokes `non-focus-terminate` on the interface.

**See also**

`prompt-with-list-non-focus`

`non-focus-terminate`
ole-control-add-verbs

Function

Summary
Adds to the menu entries for the "verbs" that a component in an ole-control-pane supports.

Signature
ole-control-add-verbs pane menu item-identifier

Arguments
pane An ole-control-pane.
menu A menu.
item-identifier A string or symbol.

Description
The function ole-control-add-verbs adds to the menu entries for the "verbs" that the component supports. The ole-control-pane pane must have an object already, and the menu menu must have already been created, so ole-control-add-verbs is typically called in the popup-callback of menu. item-identifier identifies an item in the menu or a component in the menu (but not in a sub-menu), either by being cl:eq to the name of the item or cl:equalp to the title of the item. If the item is found, it is replaced either by a sub-menu with the verbs that the object supports, or, if the object supports only one verb, by an entry for this.

When the user selects an added menu item, the verb is passed to the object (by a call to IOleObject::DoVerb).

Notes
This function is implemented only in LispWorks for Windows. Load the functionality by (require "embed").

See also
menu
ole-control-pane

ole-control-close-object

Function

Summary
Closes the object in an ole-control-pane.
Signature  

 Oliveira closes the object that is currently in the ole-control-pane pane.

Arguments  

 pane  

 An ole-control-pane.

Description  

This function is implemented only in LispWorks for Windows. Load the functionality by (require "embed").

See also  

 ole-control-pane

ole-control-component  

Class

Summary  

An implementation of the interfaces in the OLE Control protocol.

Package  

capi

Superclasses  

com:standard-i-unknown

Initargs  

:pane-function  

A function that is called when OLE embeds the Control in a container.

:create-callback  

A function called just after the pane is created.

:destroy-callback  

A function called just before the pane is destroyed.

Readers  

ole-control-component-pane
Description

The class `ole-control-component` provides an implementation of the interfaces in the OLE Control protocol, to allow a CAPI pane to be embedded in an OLE Control container implemented outside LispWorks. It is typically used with the macro `define-ole-control-component` to define a subclass of `ole-control-component` that implements a particular coclass from a type library. Instances of this class are usually created by the COM runtime system, not by explicit calls to `make-instance`.

A function designator `pane-function` must be supplied. `pane-function` that is called when OLE embeds the Control in a container. It receives the component as its argument and should return a CAPI pane that will implement the visual aspects of the control.

Note: The pane returned by `pane-function` must be a `output-pane`, `layout` or `interface` in the current implementation. The pane is stored in the component and can be accessed using the reader `ole-control-component-pane`.

`create-callback`, if non-nil, is a function called when the pane returned by `pane-function` has been created in the window system. The argument is the pane itself. `create-callback` can perform initialization such as loading images.

`destroy-callback`, if non-nil, is a function called when the pane returned by `pane-function` is going to be destroyed. The argument is the pane itself. `destroy-callback` can perform cleanups.

Notes

When using an `ole-control-component`, the normal hierarchy of CAPI objects such as a layout and an interface do not exist above it. The layout and control of the top level window is the responsibility of the application that embeds the control. It can communicate with the control by using COM/Automation.

`ole-control-component` is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`. 
See also define-ole-control-component

**ole-control-doc**

**Class**

**Summary**

A class that implements the document around the object inside an **ole-control-pane**.

**Package**

capi

**Superclasses**

pinboard-layout

**Subclasses**

ole-control-frame

**Description**

The pane class **ole-control-doc** can be used to implement the document around the object inside an **ole-control-pane**. That is, it supports the IOleInPlaceUIWindow interface. Note that this is optional, and is rarely useful.

To use it the **ole-control-doc** pane needs to be the parent, not necessarily directly, of an **ole-control-pane**. When the object calls IOleInPlaceSite::GetWindowContext, it will get (in the ppdoc [out] argument) an IOleInPlaceUIWindow interface associated with the **ole-control-doc**.

A **ole-control-doc** must have exactly one sub-pane (that is, the length of its description must be 1), but underneath this pane there can be many panes.

Normally the program does not need to do anything else with the **ole-control-doc**. It acts in response to resizing of the window and method calls from the object on the IOleInPlaceUIWindow interface.

**Notes**

**ole-control-doc** is implemented only in LispWorks for Windows. Load the functionality by (require "embed").
Even though it is a subclass of pinboard-layout, normally you should not use the pinboard-layout functionality when using ole-control-doc.

See also ole-control-pane

**ole-control-frame**

*Class*

**Summary**

Implements the frame of components in an ole-control-pane.

**Package**

capi

**Superclasses**

ole-control-doc

**Description**

The pane class ole-control-frame implements the frame of components, that is it supports the IOleInPlaceFrame interface. When an ole-control-pane pane is created, it looks upwards in the hierarchy of panes, and if finds an ole-control-frame pane it uses this as the frame. It uses the first such pane found. When the object in the ole-control-pane calls IOleInPlaceSite::GetWindowContext, it gets back in the ppframe arg an interface associated with this frame.

Like ole-control-doc, a ole-control-frame can have only one sub-pane, which itself may contain many panes.

Normally the program does not need to do anything else with the ole-control-frame. It acts in response to resizing of the window and method calls from the object on the IOleInPlaceFrame interface.

Note that having a frame is optional, and ActiveX does not need it. It is required when embedding an application by ole-control-insert-object.

**Notes**

ole-control-frame is implemented only in LispWorks for Windows. Load the functionality by (require "embed").
Even though it is a subclass of `pinboard-layout`, normally you should not use the `pinboard-layout` functionality when using `ole-control-frame`.

See also

- `ole-control-insert-object`
- `ole-control-pane`

### `ole-control-i-dispatch` Function

**Summary**

Returns the `com:i-dispatch` of the component of an `ole-control-pane`.

**Signature**

`ole-control-i-dispatch pane => result`

**Arguments**

- `pane`: An `ole-control-pane`.

**Values**

- `result`: A `com:i-dispatch` or `nil`.

**Description**

The function `ole-control-i-dispatch` returns the `com:i-dispatch` (that is, the `IDispatch` interface) of the component, or `nil` if there isn't any. The `com:i-dispatch` is the one that would be returned by `com:query-interface` on the `I-Ole-object`.

**Notes**

Calling `ole-control-i-dispatch` does not affect the reference count of the interface.

This function is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

See also

- `ole-control-pane`

### `ole-control-insert-object` Function

**Summary**

Embeds a user-specified document in an `ole-control-pane`. 
Signature  

ole-control-insert-object pane

Arguments  

pane An ole-control-pane.

Description  

The function ole-control-insert-object prompts the user for a document using the Microsoft Windows function OleUIInsertObject. When the user specifies a document in the dialog presented, ole-control-insert-object embeds this document in the ole-control-pane pane.

Notes  

This function is implemented only in LispWorks for Windows. Load the functionality by (require "embed").

See also  

ole-control-pane

ole-control-ole-object  

Function

Summary  

Returns the com:i-ole-object of the component of an ole-control-pane.

Signature  

ole-control-ole-object pane => result

Arguments  

pane An ole-control-pane.

Values  

result A com:i-ole-object or nil.

Description  

The function ole-control-ole-object returns the com:i-ole-object (that is, the IOleObject interface) of the component of the ole-control-pane pane, or nil if there isn’t any.

Notes  

Calling ole-control-ole-object does not affect the reference count of the interface.

This function is implemented only in LispWorks for Windows. Load the functionality by (require "embed")
See also  

**ole-control-pane**

---

### Class

**ole-control-pane**

**Summary**

A class that implements embedding of external components on Microsoft Windows.

**Package**

capi

**Superclasses**

pinboard-layout

**Initargs**

- **:component-name**
  
  A string or nil.

- **:user-component**
  
  A COM interface pointer or nil.

- **:save-name**
  
  A string.

- **:insert-callback**
  
  A function.

- **:close-callback**
  
  A function.

- **:sinks**
  
  A list of sink specifications.

**Description**

The class **ole-control-pane** is used to implement embedding of external components.

**Note:** **ole-control-pane** is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

**Note:** even though it is a subclass of **pinboard-layout**, normally you should not use the **pinboard-layout** functionality when using **ole-control-pane**.

**component-name** (if non-nil) specifies the **component-name** of the pane, as used by **component-name**.
user-component (if non-nil) is a COM interface pointer of an object that supports the I-OLE-OBJECT interface, and is ready to display as described in ole-control-user-component.

save-name is used when creating the IStorage object for this component.

insert-callback (if non-nil) is a function that takes a single argument, the pane. It is called immediately after a component was inserted into the pane. This can be used for any additional initialization that is required, for example setting the properties of the control.

close-callback (if non-nil) is a function that takes a single argument, the pane. It is called just before the component is going to be closed, and can be used to do any cleanups that may be required.

sinks is a list of sink specifications for attaching event handlers to the source interfaces of the control. Each element of sinks should be a list of the form:

(interface-name &key invoke-callback sink-class sink)

The interface-name is used to specify the name of the source interface in the control, which is either a string naming the interface or :default for the default source interface. If invoke-callback is given, then it should be a function which will be called with the pane, method-name, method-kind and arguments vector for each source event. The sink-class can be given to set the class of the internal object used for the sink interface. This is similar to calling attach-simple-sink. Alternatively, instead of calling invoke-callback, the sink can be specified directly. This is similar to calling attach-sink.

When the ole-control-pane is destroyed, the sinks are automatically detached.

There are currently three ways to insert an external component into an ole-control-pane. These are:
1. Call `ole-control-user-component`, which asks the user for something to insert.

2. Set the `component-name` of the pane. This can be done either via the initarg `:component-name` or by calling `(setf component-name)`.

3. Set the `user-component` of the pane, either via the initarg `:user-component` or by calling `(setf ole-control-user-component)`.

Example

```lisp
(capi:contain
 (list
  (make-instance 'capi:ole-control-pane
    :component-name "OWC.Spreadsheet.9")))
```

This is a full example:

```lisp
(example-edit-file "com/ole/html-viewer")
```

See also

- `attach-simple-sink`
- `attach-sink`
- `component-name`
- `detach-sink`
- `interface-menu-groups`
- `ole-control-add-verbs`
- `ole-control-close-object`
- `ole-control-i-dispatch`
- `ole-control-insert-object`
- `ole-control-ole-object`
- `ole-control-pane-frame`
- `ole-control-user-component`
- `report-active-component-failure`

---

**Function**

**ole-control-pane-frame**

**Summary**

Returns the `ole-control-frame` of an `ole-control-pane`.

**Signature**

`ole-control-pane-frame pane => result`
Arguments  pane  An ole-control-pane.

Values  result  An ole-control-frame or nil.

Description  The function ole-control-pane-frame returns the ole-control-frame of the ole-control-pane pane, if there is one.

Note: this function is implemented only in LispWorks for Windows. Load the functionality by (require "embed").

See also  ole-control-frame
          ole-control-pane

ole-control-pane-simple-sink  Class

Summary  A class that implements a sink interface for an embedded component on Microsoft Windows.

Package  capi

Superclasses  com:simple-i-dispatch

Initargs  :ole-control-pane
           A class instance.

Description  The class ole-control-pane-simple-sink is used by the function attach-simple-sink to implement a sink interface for an embedded component on Microsoft Windows.

ole-control-pane is the object of type ole-control-pane to whose source interface the sink is being attached.

This class can be subclassed to provide additional functionality in callbacks. See com:simple-i-dispatch in the LispWorks COM/Automation User Guide and Reference Manual for more details.
Note: `ole-control-pane-simple-sink` is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

See also

- `attach-simple-sink`
- `ole-control-pane`

### ole-control-user-component

Function

**Summary**

Gets and sets the `user-component` of an `ole-control-pane`.

**Signature**

```lisp
(ole-control-user-component pane => user-component)
(setq ole-control-user-component user-component pane => user-component)
```

**Arguments**

- `pane` An `ole-control-pane`.
- `user-component` A COM interface pointer.

**Description**

The function `ole-control-user-component` gets and sets the `user-component` of the `ole-control-pane` `pane`.

`user-component` (if non-nil) is a COM interface pointer of an object that supports the `I-OLE-OBJECT` interface, and has been opened and initialized and is ready to be displayed. This is typically created by calling `OleCreate`, `OleCreateFromFile`, `OleCreateFromData` or `OleLoad` with `pClientSite` null.

The `user-component` is closed and released by the `ole-control-pane` `pane`, so after you have called `(setq ole-control-user-component)` you should not try to use it again or release it. Setting `user-component` also sets the pane’s `component-name` to `nil`.

**Notes**

This function is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`. 
option-pane

Class

Summary
A pane which offers a choice of items, but which displays only the currently selected item.

Package
capi

Superclasses
choice
titled-object
simple-pane

Initargs
:enabled Non-nil if the option pane is enabled.
:visible-items-count An integer or the symbol :default.
:popup-callback A function called just before the popup menu appears, or nil.
:image-function A function providing images for items, or nil.
:image-lists A plist of keywords and image-list objects.
:separator-item An item that acts as a separator between other items, or nil.
:enabled-positions A list of fixnums, or the keyword :all.
:window-styles A list of keywords.
The class `option-pane` provides a pane which offers a choice between a number of items via a popup menu. Only the currently selected item is displayed.

The class `option-pane` inherits from `choice`, and so has all of the standard choice behavior such as selection and callbacks. It also has an extra `enabled` slot along with an accessor which is used to enable and disable the option pane.

`visible-items-count` is implemented only on Microsoft Windows. If `visible-items-count` is an integer then the popup menu is no longer than this, and is scrollable if there are more items. If `visible-items-count` is `:default`, then the popup menu is no longer than 10. This is the default value.

When `popup-callback` is non-nil, it should be a function of one argument that will be called just before the popup menu appears when the user clicks on it. The single argument to the function is the option pane and the return value is ignored. If required, the function can change the items or selection of the pane. The default value of `popup-callback` is `nil`.

If `image-function` is non-nil, it should be a function of one argument which is called with each item. The return value depends on `image-lists`. If `image-lists` contains an `image-list` for the `:normal` key, then the result of `image-function` should be one of the following:

A pathname or string

This specifies the filename of a file suitable for loading with `load-image`. Currently this must be a bitmap file.
A symbol

The symbol must have been previously registered by means of a call to `register-image-translation`.

An image object, as returned by `load-image`.

An image locator object

This allowing a single bitmap to be created which contains several button images side by side. See `make-image-locator` for more information. On Microsoft Windows, it also allows access to bitmaps stored as resources in a DLL.

An integer

This is a zero-based index into the option-pane’s `image-list`. This is generally only useful if the image list is created explicitly. See `image-list` for more details.

Otherwise if there is no `image-list` then it should return one of:

nil

No image is shown.

An `image` object

The pane displays this image.

An image id or an `external-image` object

The system converts the value to a temporary `image` for the item and frees it when it is no longer needed.

If `image-function` is `nil`, no items have images. This is the default value.

If `image-lists` is specified, it should be a plist containing the keyword `:normal` as a key. The corresponding value should be an `image-list` object. No other keys are supported at the present time. The `image-list` associated with the `:normal` key is used with the `image-function` (see above) to specify an image to display in each tab.
separator-item should be an item (compared using test-function) that acts as a separator between other items. A separator item is not selectable. The default value nil means that there are no separators (regardless of test-function).

If enabled-positions is :all then all the items can be selected. Otherwise the value is a list of fixnums indicating the positions in the item list which can be selected. The default value is :all.

On Microsoft Windows, if window-styles contains the keyword :simple-text-only, then the option-pane is displayed using the UI theme and the enabled-positions, separator-item, image-function and visible-items-count initargs are not supported. Otherwise it is displayed without the UI theme and those options work as documented. This is a limitation in Microsoft Windows.

Notes

1. The user cannot edit the items in an option-pane. For an element with similar functionality which allows editing, see text-input-choice.

2. :image-function and :image-lists are currently only implemented for Microsoft Windows, GTK+ and Cocoa.

3. On Motif, the separator is represented simply as a blank item between the other items.

4. On Motif and GTK+ versions older than 2.12, there is no visible representation of the disabled items.

Example

This example sets the selection and changes the enabled state of an option-pane:
(setq option-pane (capi:contain
  (make-instance 'capi:option-pane
    :items '(1 2 3 4 5)
    :selected-item 3)))

(capi:apply-in-pane-process
  option-pane #'(setf capi:choice-selected-item)
  5 option-pane)

(capi:apply-in-pane-process
  option-pane #'(setf capi:option-pane-enabled)
  nil option-pane)

(capi:apply-in-pane-process
  option-pane #'(setf capi:option-pane-enabled)
  t option-pane)

This example illustrates the use of visible-items-count (Windows only):

(capi:contain
  (make-instance 'capi:option-pane
    :items
    (loop for i below 20 collect i)
    :visible-items-count 6))

These are further examples:

(example-edit-file "capi/choice/option-pane")

(example-edit-file "capi/choice/option-pane-with-images")

There are further examples in Chapter 20, “Self-contained examples”.

See also

text-input-choice
“Controlling Mnemonics” on page 13
Chapter 5, “Choices - panes with items”
“Toolbar items other than buttons with images” on page 133
### output-pane

**Class**

**Summary**
An output pane is a pane whose display and input behavior can be controlled by the programmer.

**Package**
capi

**Superclasses**
titled-object
simple-pane
graphics-port-mixin

**Subclasses**
pinboard-layout
editor-pane

**Initargs**

- **:display-callback**
  A function called to redisplay the pane.

- **:drawing-mode**
  A keyword controlling quality of drawing, especially anti-aliasing of text.

- **:graphics-options**
  A platform-specific plist of options controlling how graphics are drawn.

- **:draw-with-buffer**
  A boolean controlling whether output is buffered, on Microsoft Windows and Motif.

- **:input-model**
  A list of input specifications, otherwise known as a command table.

- **:scroll-callback**
  A function called when the pane is scrolled, or nil. The default is nil.
:pane-can-scroll
A generalized boolean specifying whether the pane itself is responsible for drawing into the visible area.

:focus-callback
A function called when the pane gets or loses the input focus, or nil. The default is nil.

:resize-callback
A function called when the pane is resized, or nil. The default is nil.

:create-callback
A function called just after the pane is created.

:destroy-callback
A function called just before the pane is destroyed.

:use-native-input-method
Controls whether to use native input method to interpret keyboard input. Currently this has an effect only on GTK+.

:composition-callback
This is called for various events related to composition, which here means composing input characters into other characters by an input method.
Accessors

- output-pane-display-callback
- output-pane-focus-callback
- output-pane-resize-callback
- output-pane-scroll-callback
- output-pane-create-callback
- output-pane-destroy-callback
- output-pane-composition-callback
- output-pane-input-model

Readers

- output-pane-graphics-options

Description

The class `output-pane` is a subclass of `gp:graphics-port-mixin` which means that it supports the graphics ports drawing operations such as `draw-image`, `draw-string` and `draw-path`.

When the CAPI needs to redisplay a region of the output pane, the `display-callback` gets called with the `output-pane` and the `x`, `y`, `width` and `height` of the region that needs redrawing. The `display-callback` should then use Graphics Ports functions to redisplay that area. To force an area to be re-displayed, use the function `invalidate-rectangle`.

Note: if you need to temporarily prevent the `display-callback` from running, for example because it is slow, then use the Cached Display interface so that the pane still redraws. See `output-pane-cache-display` for the details.

`drawing-mode` should be either `:compatible` which causes drawing to be the same as in LispWorks 6.0, or `:quality` which causes all the drawing to be transformed properly, and allows control over anti-aliasing on Microsoft Windows and GTK+. The default value of `drawing-mode` is `:quality`.

For more information about `drawing-mode`, see “The drawing mode and anti-aliasing” on page 209.

`graphics-options` is currently only used by the Mac OS X Cocoa implementation. The single option defined is `:text-rendering`, with allowed values:
:glyph  Draw glyphs directly using Core Graphics. This only draws characters with glyphs in the chosen font.

:atsui  Draw using ATSUI APIs where possible. This is slower but can handle more characters.

When draw-with-buffer is true, display of the output-pane (that is drawing the background and calling the display-call-back) is done by first drawing to a pixmap buffer, and then drawing from that buffer. This is useful to avoid flickering if the display is complex. The default value of draw-with-buffer is nil.

The input-model provides a means to get callbacks on mouse and keyboard gestures. An input-model is a list of mappings from gesture to callback, where each mapping is a list

\[(\text{gesture} \ \text{callback} \ . \ \text{extra-callback-args})\]

gesture specifies the type of gesture, which can be Gesture Spec (representing keyboard input), character, mouse button (including multiple clicks made in quick succession), modifier change, key, command or cursor motion. On Microsoft Windows and Cocoa gesture can also specify multi-touch gestures that come from trackpad or touchscreen devices, including zoom, rotate, pan and more.

gesture can match specific input such as uppercase A with the Control key pressed, or a general class of input such as any character.

input-model can be set before the pane is displayed, but changes after that are ignored. cl:initialize-instance is the natural place for subclasses to modify the existing input-model, using the output-pane accessor output-pane-input-model. Note that since the mappings are processed in order, prepending to an existing input-model overrides it when there are clashes, while appending affects only gestures for which the original input-model did not have a match.
For all the details of input-model syntax and the precedence and interpretation of the various gesture types, see “Detailed description of the input model” on page 179.

If pane-can-scroll is true then the pane is responsible for handling scrolling, by redrawing. It should draw into the visible area according to the scroll parameters. This is known as internal scrolling and an example is editor-pane. If pane-can-scroll is nil, then the CAPI is responsible for scrolling over the data range. The default value is nil. This is known as ordinary scrolling and there is an example in output-panes/scroll-test.lisp.

When the output pane is scrolled, the CAPI calls the scroll-callback if this is non-nil. The arguments of the scroll callback are the output-pane, the direction (:vertical, :horizontal or :pan), the scroll operation (:move, :drag, :step or :page), the amount of scrolling (an integer), and a keyword argument :interactive. This has value t if the scroll was invoked interactively, and value nil if the scroll was programmatic, such as via the function scroll. In the Mac OS X Cocoa implementation the direction is always :pan. See the following CAPI example files:

output-panes/scroll-test.lisp
output-panes/scrolling-without-bar.lisp
graphics/scrolling-test.lisp

focus-callback, if non-nil, is a function of two arguments. The first argument is the output-pane itself, and the second is a boolean. When the output-pane gets the focus, focus-callback is called with second argument t, and when the output-pane loses the focus, focus-callback is called with second argument nil.

resize-callback, if non-nil, is a function of five arguments called when the output-pane is resized. The first argument is the output-pane itself, and the rest are its new geometry: x, y, width and height.
create-callback, if non-nil, is a function of one argument which is called just after the pane is created (but before it becomes visible). The argument is the pane itself. This function can perform initialization such as loading images.

destroy-callback, if non-nil, is a function of one argument which is called just before the pane is destroyed, for example when the window is closed or the pane is removed from its layout. The argument is the pane itself. This function can perform cleanup operations (though note that images associated with the pane are automatically freed).

use-native-input-method should be nil, t or :default. If use-native-input-method is not supplied, or is :default, the default is used, which is controlled by set-default-use-native-input-method. The default setting is always to use native input methods.

composition-callback is a function with signature

composition-callback pane what

where pane is the output pane and what can be one of:

:start The composition operation is starting.
:end The composition ends.

A list A plist describing the "preedit" string, which is a string containing the partial input that should be displayed while the composition is ongoing. These calls with a plist occur only when the underlying system does not display the partial input itself. Currently on Microsoft Windows the system always displays the preedit string itself, so these calls occur only on GTK+ and Cocoa.

During composition there will be repeated calls with a list, in general each time that the preedit string changes. Each call is a complete description of what needs to be displayed. The data from previous calls should be ignored.
The keys that can appear in the plist are currently:

:string-face-lists
The value is a list where each element is itself a list, where the first element is a string and the second a plist describing a face (a face plist). The strings are the strings that need to be displayed, and the face plist describing the face that the underlying GUI thinks that each string needs to be displayed. The face plist may contain any of the following keywords: :foreground, :background, :font, :bold-p, :italic-p, :underline-p. The argument string-face-lists may be nil, which means display nothing.

cursor
The argument is an integer describing where the "cursor" should be displayed. The index is into the string that is concatenation of the strings in string-face-lists.

:selected-range
If present, the value specifies the selected range as a cons of start and length in characters. The start is an index into the string that is a concatenation of the strings in the string-face-lists.

:selection-needs-face
A boolean specifying whether the selected range should have a different face to the unselected range.

The editor uses the :start call to position the composition window at the cursor by using set-composition-placement and the calls with a list to display the partial composition string.
Notes

1. A composition session is initiated and managed by the underlying windowing system (not CAPI) when it is set to use input method which needs to compose characters from several keyboard gestures (mostly input methods for east Asian languages). Keyboard gestures that are used by the composition session are not visible to the application, but some keyboard gestures, typically gestures with modifiers, may be passed through.

2. When the user commits the composition session, the user callbacks from the input-model are called on each character in the resulting string (as if the user typed each of these characters). The call to composition-callback with :start should typically use set-composition-placement to tell the system where the interaction should happen. The calls to composition-callback with a list do not always happen, the underlying system may do it all itself.

3. You can stop an ongoing composition session by calling output-pane-stop-composition. That is useful for gestures like mouse clicks that may change the interaction such that it does not make sense to continue the composition.

4. draw-with-buffer is typically useful for a pinboard-layout with large number of pinboard objects, or any other feature that may cause it to flicker.

5. The GTK+ and Cocoa libraries always buffer, so draw-with-buffer is ignored on these platforms.

6. In GTK+ versions before 2.12 the :start and :end calls are not reliable.

Example

Firstly, here is an example that draws a circle in an output pane.
(defun display-circle (self x y width height)
  (declare (ignore x y width height))
  (gp:draw-circle self 200 200 200 :filled t))

(capi:contain (make-instance 'capi:output-pane
  :display-callback 'display-circle
  :best-width 200 :best-height 200)

Here is an example that shows how to use a button gesture.

(defun test-callback (self x y)
  (capi:display-message
   "Pressed button 1 at (~S,~S) in -S x y self")

(capi:contain (make-instance 'capi:output-pane
  :title "Press button 1:
  :input-model `(((:button-1 :press) test-callback))
  :best-width 200 :best-height 200)

This example illustrates Gesture Spec mappings.
(defun draw-input (self x y gspec)
  (let ((data (sys:gesture-spec-data gspec))
        (mods (sys:gesture-spec-modifiers gspec)))
    (gp:draw-string
      self
      (with-output-to-string (ss)
        (sys:print-pretty-gesture-spec
          gspec ss :force-shift-for-upcase nil))
      x y)))

(capi:contain
 (make-instance 'capi:output-pane
 :title "Press keys in the pane..."
 :input-model '((:gesture-spec draw-input)))
 :best-width 200 :best-height 200)

(capi:contain
 (make-instance 'capi:output-pane
 :title "Press Control-a in the pane..."
 :input-model '((:gesture-spec "Control-a")
                draw-input))
 :best-width 200 :best-height 200)

Here is a simple example that draws the character typed at the cursor point.

(defun draw-character (self x y character)
  (gp:draw-character self character x y))

(capi:contain
 (make-instance 'capi:output-pane
 :title "Press keys in the pane..."
 :input-model '((:character draw-character)))
 :best-width 200 :best-height 200)

This example shows how to use the motion gesture.
(defun draw-red-blob (self x y)
  (gp:draw-circle self x y 3
    :filled t
    :foreground :red))

(capi:contain
  (make-instance 'capi:output-pane
    :title "Drag button-1 across this pane."
    :input-model '(((:button-1 :motion) gp:draw-point)
                   ((:button-1 :motion :control) draw-red-blob))
    :best-width 200 :best-height 200)

This example illustrates the use of focus-callback:

(capi:contain
  (make-instance 'capi:output-pane
    :focus-callback #'(lambda (x y)
      (format t "Pane -.~a~:~[lost~;got~] the focus-.~a"
      x y)))

This example illustrates the use of graphics-options to specify ATSUI drawing on Cocoa:

(defvar *string*
  (coerce (loop for i from 0 below 60
                collect (code-char (* 5 i)))
    'text-string))

(capi:contain
  (make-instance 'capi:output-pane
    :visible-min-width 400
    :visible-max-height 50
    :display-callback #'(lambda (pane x y w h)
      (gp:draw-string pane
        *string*
        10 10))
    :graphics-options '(:text-rendering :atsui))

This example illustrates some effects of drawing-mode:
This example shows how to draw a rectangle indicating selection of objects in response to mouse movement:

These two examples illustrate drawing the results of dynamic computation:

There are further examples here:

See also Chapter 20, “Self-contained examples”.

See also

define-command
pane-modifiers-state
output-pane-resize
output-pane-stop-composition
pinboard-object
scroll
set-default-use-native-input-method
set-composition-placement
“Toolips” on page 35
Chapter 7, “Programming with CAPI Windows”
“Popup menus for panes” on page 122
Chapter 12, “Creating Panes with Your Own Drawing and Input”
Chapter 13, “Drawing - Graphics Ports”
“Rendering of colors” on page 242
Chapter 16, “Printing from the CAPI—the Hardcopy API”
Chapter 17, “Drag and Drop”
output-pane-cache-display

**Function**

**Summary**
Caches the display of an output pane, ready for later drawing.

**Package**
capi

**Signature**
output-pane-cache-display output-pane &optional from-display-p

**Arguments**
output-pane  An output-pane.
from-display-p  A generalized boolean.

**Description**
The function `output-pane-cache-display` caches the display of the output-pane output-pane, that is what it currently shows. The result can be used later by `output-pane-draw-from-cached-display`.

When `from-display-p` is false the cached display is created by a "dummy" call to the `display-callback` of output-pane. If `from-display-p` is true the cached display is created by copying whatever is currently showing on the screen. Note that any obscured part of the pane will not be copied in this case. The default value of `from-display-p` is false.

Before caching the display, `output-pane-cache-display` performs an implicit call to `output-pane-free-cached-display`, which undoes the effect of all previous Cached Display interface calls.

**Notes**

1. Caching the display is useful when you want to avoid calls to the `display-callback` during some period, which may be because it is slow or perhaps some other reason.

2. The Cached Display interface functions do not affect the `display-callback` and it is your responsibility to prevent the `display-callback` being called. See `output-pane-draw-from-cached-display` for more information.
See also
output-pane
draw-from-cached-display
free-cached-display
start-drawing-with-cached-display
"Transient display on output-pane and subclasses" on page 202

output-pane-cached-display-user-info  Function

Summary
Gets and sets the user-info in the current cached display of an output pane.

Package
capi

Signature
output-pane-cached-display-user-info pane => user-info
(setf output-pane-cached-display-user-info) user-info pane

Arguments
pane  An output-pane.

Values
user-info  A Lisp object.

Description
The function output-pane-cached-display-user-info gets and sets the user-info in the current cached display of the output pane pane.

If pane does not have a cached display, the getter returns nil and the setter has no effect (but returns the new user-info as per normal Common Lisp conventions).

A value that is set by the setter will be returned by the getter until the cached display is freed by a call to output-pane-free-cached-display, either explicitly or implicitly. Note that this means that calls to start-drawing-with-cached-display and output-pane-cache-display also reset the user-info.
output-pane-draw-from-cached-display

Function

Summary
Draws from the cached display of an output pane.

Package
capi

Signature
output-pane-draw-from-cached-display pane x y width height

Arguments
pane
An output-pane.
x, y, width, height Real numbers.

Description
The function output-pane-draw-from-cached-display copies into the output pane pane from the last cached display in the region specified by the given coordinates.

Notes
The Cached Display interface functions do not affect the display-callback of pane. It is your responsibility to prevent the display-callback being called, and instead use output-pane-draw-from-cached-display. One way of achieving this is to have a display-callback that does:

(if (drawing-from-cached-display-p pane)
   (progn
     (output-pane-draw-from-cached-display pane x y width height)
     (draw-some-temporary-stuff pane)
     (real-display-callback pane x y width height))
)

Another way is to replace the display-callback for a while.

See also start-drawing-with-cached-display, which replaces the display-callback too.
See also
  output-pane-cache-display
  output-pane-free-cached-display
  start-drawing-with-cached-display
  “Transient display on output-pane and subclasses” on page 202

output-pane-free-cached-display  Function

Summary  Frees the cached display in an output pane.

Package  capi

Signature  output-pane-free-cached-display  pane => user-info

Arguments  pane  An output-pane.

Values  user-info  A Lisp object.

Description  The function output-pane-free-cached-display frees the last cached display. This is useful because the cached display can be large in memory.

output-pane-free-cached-display returns the user-info that is associated with the cached display. Such user-info can be set either by (setf output-pane-cached-display-user-info) or by passing user-info to start-drawing-with-cached-display.

Notes  1. output-pane-free-cached-display also undoes any effect of start-drawing-with-cached-display.

2. The Cached Display interface functions do not affect the display-callback and it is your responsibility to prevent the display-callback being called. See output-pane-draw-from-cached-display for more information.
Examples

This file illustrates the use of `output-pane-free-cached-display` in a drag operation:

(example-edit-file "capi/output-panes/cached-display")

See also

output-pane-cache-display
start-drawing-with-cached-display
“Transient display on output-pane and subclasses” on page 202

output-pane-resize

*Generic Function*

Summary

Called when an `output-pane` is resized.

Package
capi

Signature

`output-pane-resize output-pane x y width height`

Method signature

`output-pane-resize output-pane t t t t`

Arguments

`output-pane` An `output-pane`.

`x, y, width, height` Non-negative integers.

Description

The generic function `output-pane-resize` is called when the `output-pane` `output-pane` is resized. `width` and `height` specify the new width and height. `x` and `y` specify the position, but are not reliable and should not be used.

`output-pane-resize` should not called by the user.

The primary method specialized on `output-pane` sets up internal slots and calls the `resize-callback`.

Notes

1. Normally you respond to resizing by specifying the `resize-callback` with the `:resize-callback` initarg. It is useful to define your own `output-pane-resize` method
only when you define your own subclass of `output-pane` which needs to do something when resizing, and you want to allow different `resize-callbacks` for individual instances of this class.

2. `output-pane-resize` should not draw anything. Newly-exposed areas are automatically displayed by a later call to the `display-callback`. If areas that are already exposed need redrawing, `output-pane-resize` should call `invalidate-rectangle` to mark these areas for the `display-callback`.

See also `output-pane` `invalidate-rectangle`

**output-pane-stop-composition**

*Function*

**Summary**

Stops the ongoing composition.

**Package**

`capi`

**Signature**

```
output-pane-stop-composition output-pane &key process-p x y => result
```

**Arguments**

- `output-pane` An `output-pane`.  
- `process-p` A generalized boolean.  
- `x, y` An integer or `nil`.

**Values**

- `result` A string or `nil`.

**Description**

The function `output-pane-stop-composition` stops the ongoing composition session if there is any, returning the currently composed string.
If `process-p` is true and there is a composition, the current composition string is processed as if the user committed it. That is, for each character, the user callbacks from the input model are invoked as if it was typed by the user. The default value of `process-p` is `nil`.

`x` and `y` provide coordinates for the callbacks. If either of them is `nil`, the current pointer position is used. When `process-p` is `nil`, `x` and `y` are ignored.

`output-pane-stop-composition` returns the current composition string, if any, or `nil`.

**Notes**

1. A composition session is initiated and managed by the underlying windowing system (not CAPI) when it is set to use an input method which needs compositioning (mostly input methods for east Asian languages). You can tell when it happens by using `:composition-callback` in `output-pane`.

2. Calling `output-pane-stop-composition` when there is no composition session has no effect.

3. You will typically need to use `output-pane-stop-composition` when a gesture that is not processed by the input method (for example a mouse click) changes the interaction such that it does not make sense to continue the composition.

**See also** `output-pane`
The generic function \texttt{over-pinboard-object-p} returns non-nil if the \texttt{x} and \texttt{y} coordinates specify a point within the boundary of a pinboard object. To find the actual object at this position, use \texttt{pinboard-object-at-position}.

The default method returns \texttt{t} if \texttt{x} and \texttt{y} are within the bounding area of the pinboard object. A method is supplied for \texttt{line-pinboard-object} and you may add methods for your own \texttt{pinboard-object} subclasses.

\textbf{See also}\quad \texttt{pinboard-object-at-position}\newline \texttt{pinboard-object-overlap-p}\newline \texttt{pinboard-object}\newline \texttt{pinboard-layout}

\textbf{page-setup-dialog} \quad \textit{Function}

\textbf{Summary}\quad Displays the page setup dialog for a given printer.

\textbf{Package}\quad \texttt{capi}

\textbf{Signature}\quad \texttt{page-setup-dialog \&key screen owner printer continuation}

\textbf{Description}\quad The function \texttt{page-setup-dialog} displays the page setup dialog for \texttt{printer}. If \texttt{printer} is not specified, the dialog for the current printer is displayed.

The CAPI screen on which to display the dialog is given by \texttt{screen}, which is the current screen by default.

\textit{owner} specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If \texttt{continuation} is non-nil, then it must be a function with a lambda list that accepts one argument. The \texttt{continuation} function is called with the values that would normally be
returned by `page-setup-dialog`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `display-dialog` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.

**Examples**

```
(example-edit-file "capi/printing/simple-print-port")
```

**See also**

`current-printer`

“Printing from the CAPI—the Hardcopy API” on page 249

---

**pane-adjusted-offset**

*Generic Function*

**Summary**

Calculates the offset required to place a pane correctly in a layout.

**Package**

capi

**Signature**

```
pane-adjusted-offset pane adjust available-size actual-size &key &allow-other-keys
```

**Description**

The generic function `pane-adjusted-offset` calculates the offset required by the `adjust` keyword so that the pane `pane` is placed correctly within the available space in its parent layout. It is called by all of the layouts that inherit from `x-y-adjustable-layout` to interpret the values of `x-adjust` and `y-adjust`.

Typically the value of `adjust` will be a keyword or a list of the form `(keyword n)` where `n` is an integer. These values of `adjust` are interpreted as by `pane-adjusted-position`.

However, new methods can accept alternative values for `adjust` where required and can also add extra keywords. For example, `grid-layout` allows `adjust` to be a list of `adjust` values, and then passes the offset into this list as an additional keyword.
Notes

1. pane-adjusted-offset is deprecated.

2. Only a keyword value for adjust should be supplied when pane is a column-layout or row-layout.

Example

(setq button-panel (make-instance 'capi:button-panel
   :items '(1 2 3)))

(capi:pane-adjusted-offset button-panel
   :center 200 100)

(capi:pane-adjusted-offset button-panel
   :left 200 100)

(capi:pane-adjusted-offset button-panel
   :right 200 100)

See also

layout
x-y-adjustable-layout

pane-adjusted-position

Generic Function

Summary

Calculates how to place a pane correctly within a layout, given a minimum and maximum position.

Package

capi

Signature

pane-adjusted-position pane adjust min-position max-position &key &allow-other-keys

Description

The generic function pane-adjusted-position calculates the position required by the adjust argument so that the pane pane is placed correctly within the available space in its parent layout, given a minimum and maximum position. It is a complementary function to pane-adjusted-offset, and the default method actually calls pane-adjusted-offset with the gap between the two positions, and then adds on the minimum position to get the new position.

The default method accepts the following values for adjust.
Place Pane at the top of the region.
Place pane at the bottom of the region.
Place pane at the left of the region.
Place pane at the right of the region.
Place pane in the center of the region.
Place the top of pane n pixels below the top of the region.
Place the bottom of pane n pixels above the bottom of the region.
Place the left of pane n pixels after the left of the region.
Place the right of pane n pixels before the right of the region.
Place the center of pane n pixels below the center of the region.

However, new methods can accept alternative values for adjust where required and can also add extra keywords. For example, grid-layout allows adjust to be a list of adjust values, and then passes the offset into this list as an additional keyword. It is preferable to add new methods to pane-adjusted-offset as these changes will be seen by the default method of pane-adjusted-position.

pane-adjusted-position is deprecated.

Example

(setq button-panel (make-instance 'capi:button-panel :items '(1 2 3)))

(capi:pane-adjusted-position button-panel :center 100 200)

(capi:pane-adjusted-position button-panel :right 100 200)

(capi:pane-adjusted-position button-panel :left 100 200)
See also
layout
graph-pane
x-y-adjustable-layout

**pane-can-restore-display-p**

*Function*

**Summary**
The predicate for whether a pane's disabled display can be restored.

**Package**
capi

**Signature**
pane-can-restore-display-p pane => result

**Arguments**
pane A CAPI pane.

**Values**
result A boolean.

**Description**
The function `pane-can-restore-display-p` is the predicate for whether a pane that has its display disabled can be restored by `pane-restore-display`. `result` is `t` if `pane` has its display disabled and this can be restored by `pane-restore-display`. Otherwise `result` is `nil`.

See also
`pane-restore-display`` “Restoring display while debugging” on page 264

**pane-close-display**

*Function*

**Summary**
Closes the X display of a pane.

**Package**
capi

**Signature**
pane-close-display pane => closedp
Arguments

pane

A CAPI element.

Values

closedp

A boolean.

Description

The function `pane-close-display` closes the X display connection on which `pane` is currently displayed. This destroys all the other panes on the same connection.

closedp is true if the connection was closed.

Notes

`pane-close-display` is deprecated. It has no effect on Microsoft Windows and Cocoa, and may not do anything useful on GTK+ either

**pane-descendant-child-with-focus**

*Function*

Summary

Finds the child with the input focus.

Signature

`pane-descendant-child-with-focus pane => result`

Arguments

pane

A pane or layout.

Values

result

A pane or nil.

Description

The function `pane-descendant-child-with-focus` attempts to find the pane inside `pane` that currently has the input focus, and returns this pane if successful.

`pane-descendant-child-with-focus` may return `nil` if it does not find a pane with the focus.

See also

`pane-has-focus-p`

"Focus" on page 14
**pane-got-focus**

*Generic Function*

**Summary**
A function called when the focus is set programmatically.

**Package**
capi

**Signature**
`pane-got-focus` `interface` `pane`

**Arguments**
- `interface` The interface of `pane`.
- `pane` A CAPI element.

**Description**
The generic function `pane-got-focus` is called just before the focus is set by `set-object-automatic-resize`.

The supplied primary method does nothing. You may add methods on your own interface classes, which can be useful for example when the focus is set programmatically to a pane which is hidden inside a `tab-layout` or `switchable-layout`. Your method can check for this case and modify the layout as required.

**See also**
- `set-object-automatic-resize`
- “Focus” on page 14

---

**pane-has-focus-p**

*Generic Function*

**Summary**
Determines whether a pane has the focus.

**Package**
capi

**Signature**
`pane-has-focus-p` `pane` => `focusp`

**Arguments**
- `pane` A CAPI element.

**Values**
- `focusp` A boolean.
Description

The function `pane-has-focus-p` is the predicate for whether `pane` currently has the input focus.

Notes

On Motif, `pane-has-focus-p` cannot be used in menu functions such as the `enabled-function` or `popup-callback` of a menu item. It will always return `nil`, because the focus is on the menu button when the user clicks on it.

See also

`accepts-focus-p`  
`pane-descendant-child-with-focus`  
`set-object-automatic-resize`  
“Focus” on page 14

`pane-initial-focus`  

Generic Function

Summary

Gets or sets the initial focus pane.

Package

capi

Signature

`pane-initial-focus` `pane-with-children` `=>` `pane`

Arguments

`pane-with-children`  

A pane with children.

Values

`pane`  

A child of `pane-with-children`.

Description

The generic function `pane-initial-focus` returns the child of `pane-with-children` that has the input focus when `pane-with-children` is first displayed.

 `(setf pane-initial-focus)` may be used to set the initial focus pane, but only before `pane-with-children` has been created. If the setter is called after `pane-with-children` has been created, an error is signalled.
pane-with-children should be a pane with child panes such as a layout, an interface, a button-panel or a toolbar.

See also pane-has-focus-p
“Focus” on page 14

pane-interface-copy-object
pane-interface-copy-p
pane-interface-cut-object
pane-interface-cut-p
pane-interface-deselect-all
pane-interface-deselect-all-p
pane-interface-paste-object
pane-interface-paste-p
pane-interface-select-all
pane-interface-select-all-p
pane-interface-undo
pane-interface-undo-p

Generic Functions

Summary
Implements "edit/select operations" and the associated predicates for the active pane.

Signature

pane-interface-copy-object pane interface => object, string, plist
pane-interface-copy-p pane interface
pane-interface-cut-object pane interface
pane-interface-cut-p pane interface
pane-interface-deselect-all pane interface
pane-interface-deselect-all-p pane interface
pane-interface-paste-object pane interface
Description

The active pane "edit/select operations" call these generic functions when the active pane does not specify how to perform the operation. Do not call these directly.

\textit{interface} is the top level interface of the pane. The predicate functions (those with names ending with -p) should return true if the operation can be performed. The other functions should perform the operations.

You can implement your own methods specializing on pane and interface classes.

Notes

1. These generic functions should not display a dialog or do anything that may cause the system to hang. In general this means interacting with anything outside the Lisp image, including files, databases and so on.

2. The three return values of \texttt{pane-interface-copy-object} are passed to \texttt{set-clipboard}.

See also

- \texttt{active-pane-copy}
- \texttt{item-pane-interface-copy-object}
- \texttt{set-clipboard}

“Edit actions on the active element” on page 104

\texttt{pane-modifiers-state} \hspace{1cm} \textit{Function}

Summary

Returns an integer describing which modifiers are currently active.
Package: capi

Signature: pane-modifiers-state pane => gesture-spec-bits

Arguments: pane A CAPI pane.

Values: gesture-spec-bits An integer or nil.

Description: The function pane-modifiers-state returns an integer describing which modifiers are currently pressed. The modifiers are Control, Shift, Meta and Hyper (representing Command on Mac OS X). It also describes whether Caps Lock is currently on.

pane should be a pane that is displayed on the screen. If it is not displayed, pane-modifiers-state returns nil.

The result is a cl:logior of the sys:gesture-spec-*-bit constants for the active modifiers. For example, to check if the Control modifier is currently pressed call:

(logtest (pane-modifiers-state pane)
        sys:gesture-spec-control-bit)

The possible bits are:

- sys:gesture-spec-shift-bit
- sys:gesture-spec-control-bit
- sys:gesture-spec-meta-bit
- sys:gesture-spec-hyper-bit
- sys:gesture-spec-caps-lock-bit

The Caps Lock bit behaves in a special way: it is on when Caps is locked, rather than when the Caps Lock key is pressed.

Notes: On Cocoa sys:gesture-spec-hyper-bit is for Command.

output-pane supports responding to modifier changes - see :modifier-change in the input-model.

See also  
output-pane
“Modifier keys state” on page 264

### pane-popup-menu-items

**Generic Function**

**Summary**
Generates the items for the menu associated with a pane.

**Package**
capi

**Signature**
`pane-popup-menu-items  pane  interface  =>  items`

**Arguments**
- `pane` A pane in interface `interface`.
- `interface` An interface.

**Values**
- `items` A list in which each element is a `menu-item`, `menu-component` or `menu`.

**Description**
The generic function `pane-popup-menu-items` generates the items for the menu associated with the pane `pane`. The default method of `make-pane-popup-menu` calls `pane-popup-menu-items` to find the items for the menu. If `pane-popup-menu-items` returns `nil`, then `make-pane-popup-menu` returns `nil`.

To specify items for menus associated with panes in your interfaces, define `pane-popup-menu-items` methods specialized on your interface class.

For most supplied CAPI pane classes, the system method returns `nil`. The exceptions are `editor-pane` and `graph-pane`. To inherit the items from the system method (or other more general method), call `call-next-method`.

**Notes**
1. `pane-popup-menu-items` is not supported for text panes on Cocoa such as `rich-text-pane`.

712
2. **pane-popup-menu-items** is intended to allow multiple calls on the same pane, to generate menus in different places (as in the example in `make-pane-popup-menu`). Therefore the *menu-objects* that it returns, and their descendant *menu-objects*, must be constructed each time that **pane-popup-menu-items** is called, so that no two menus share any menu item.

3. The *items* returned by **pane-popup-menu-items** may specify the arguments for their callbacks, but it is not required. If they do not specify the arguments, then `make-pane-popup-menu` (by calling `make-menu-for-pane`) sets up the callbacks such that they are called on the pane *pane*.

**Example**

The methods below specialized on interface class `edgraph`:

1. Append the items that were returned by the system method in the bottom of the menu for the *editor-pane*, and

2. Add them as a sub-menu for the menu of the *graph-pane*. 
(capi:define-interface edgraph ()
 ()
 (:panes
  (el capi:editor-pane)
  (g1 capi:graph-pane))
 (:layouts
  (main-layout capi:column-layout '(el g1)))
  (:menu-bar )
  (:default-initargs
  :visible-min-width 200
  :visible-min-height 300))

(defun my-callback (pane)
  (capi:display-message "Callback on pane ~S." pane))

(defmethod capi:pane-popup-menu-items
  ((self capi:editor-pane) (interface edgraph))
  (list*
   (make-instance 'capi:menu-item
     :title "Item for My Editor Menu."
     :selection-callback 'my-callback)
   (call-next-method)))

(defmethod capi:pane-popup-menu-items
  ((self capi:graph-pane) (interface edgraph))
  (list
   (make-instance 'capi:menu-item
     :title "Item for My Graph Menu."
     :selection-callback 'my-callback)
   (capi:make-menu-for-pane self (call-next-method)
     :title "Default Graph Menu")))

(capi:display (make-instance 'edgraph))

This is a further example:

(example-edit-file "capi/elements/pane-popup-menu-items")

See also

make-pane-popup-menu

"Popup menus for panes" on page 122
**pane-restore-display**

*Function*

**Summary**
Restores the disabled display of a pane if possible.

**Package**
capi

**Signature**
pane-restore-display pane => result

**Arguments**
pane A CAPI pane.

**Values**
result A boolean.

**Description**
The function `pane-restore-display` restores the disabled display of the pane `pane` if possible.

If the display of `pane` is disabled and can be restored, the function `pane-restore-display` restores it and returns `t`. Otherwise it returns `nil`.

The display of a pane may be disabled to a "restorable" state by some feature, typically a restart around the display callback. For example, if there is an error inside the `display-callback` of an `output-pane`, a restart is added that removes the display callback. If this restart is used, the `output-pane` is not displayed (its `display-callback` is not called) until it is restored (or the `display-callback` gets set explicitly).

**Examples**
The Window Browser tool in the LispWorks IDE uses `pane-restore-display` in the `Enable Display` item in its menu.

**See also**
`pane-can-restore-display-p`
"Restoring display while debugging" on page 264

**pane-screen-internal-geometry**

*Function*

**Summary**
Returns the internal geometry of the monitor in which a pane's interface is displayed.
Package: capi

Signature: pane-screen-internal-geometry pane => x, y, width, height

Arguments:
- pane: A CAPI pane.

Values:
- x: An integer.
- y: An integer.
- width: A positive integer.
- height: A positive integer.

Description:
The function `pane-screen-internal-geometry` returns the internal geometry of the "monitor" in which the interface that contains `pane` is displayed. A "monitor" is typically a physical monitor, but can be anything that the underlying GUI system considers a monitor.

`pane` must be inside an interface that is already displayed. `pane-screen-internal-geometry` returns the internal geometry of the monitor on which this interface is displayed. If the interface spreads across multiple monitors, it returns the geometry for the monitor on which the largest area of the interface is displayed.

The internal geometry of a monitor is a rectangle which excludes "system areas" like taskbars and global menu bars and so on. Examples of these include the Windows taskbar, the Mac OS X menu bar, and the Mac OS X Dock. See `screen-internal-geometry` for information about displaying CAPI windows in system areas.

`x, y, width` and `height` specify a screen rectangle, in which the `x` and `y` coordinates are offsets from the top-left of the primary monitor.
On GTK+ the internal geometry is of the workspace in which the interface is displayed. When there are multiple monitors these values may be incorrect. You can check the number of monitors by `screen-monitor-geometries`.

See also  
- `screen-internal-geometry`
- `screen-internal-geometries`
- `virtual-screen-geometry`
- “Screens” on page 36
- “Support for multiple monitors” on page 41
- “Querying and modifying interface geometry” on page 151

**pane-string**  
*Generic Function*

**Summary**  
Returns the text displayed in an `editor-pane`.

**Package**  
capi

**Signature**  
`pane-string pane => text`

**Arguments**  
`pane`  
An `editor-pane`.

**Values**  
`text`  
A string.

**Description**  
The generic function `pane-string` returns as a string the text of the buffer that is currently displayed in the `editor-pane` `pane`.

**Notes**  
`pane-string` is deprecated. Use the accessor `editor-pane-text` instead.

**See also**  
`editor-pane`
pane-supports-menus-with-images  

Function

Summary Tests whether a pane supports menus with images.

Signature pane-supports-menus-with-images pane => result

Arguments pane A displayed CAPI pane.

Values result A boolean.

Description The function pane-supports-menus-with-images returns t if the pane supports menus with images. This means that the menus display both the images and the text correctly.

See the image-function of menu for details of creating a menu with images.

When pane-supports-menus-with-images returns nil, menus can display images, but not together with text at the same item. They may also display images with transparency incorrectly.

Whether the pane supports menus with images depends on the library in which it is displayed. Support is currently limited to GTK+ and Cocoa.

See also menu
Chapter 8, “Creating Menus”

parse-layout-descriptor  

Generic Function

Summary Returns the object that layout uses for displaying a child.

Package capi

Signature parse-layout-descriptor child-descriptor interface layout => result
<table>
<thead>
<tr>
<th>Arguments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>child-descriptor</td>
<td>An <strong>element</strong>, a symbol, a geometry object or a string.</td>
</tr>
<tr>
<td>interface</td>
<td>An <strong>interface</strong>.</td>
</tr>
<tr>
<td>layout</td>
<td>A <strong>layout</strong>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>result</td>
<td>An <strong>element</strong> or a geometry object.</td>
</tr>
</tbody>
</table>

**Description**

The generic function `parse-layout-descriptor` takes a description of a layout's child, and returns the object that the layout is actually going to use. The returned object is an element (**simple-pane** or **pinboard-object**) or a geometry object (the result of call to the default method of `parse-layout-descriptor`).

`parse-layout-descriptor` is called by `interpret-description` to parse individual children in a layout.

The default method accepts a `child-descriptor` argument which can be one of:

- An **element**.
- A symbol naming a slot in the interface which contains an **element**.
- A geometry object.
- A string (used to construct a **title-pane** or **item-pinboard-object** with the string as its **text**).

Note that when `parse-layout-descriptor` is passed an element, it does not necessarily return that element. For example, it may wrap it with some layout that adds functionality. It may also return a completely separate element.

You can define your own methods, which may specialize on the interface, the layout if you define your own layout class(es), or the description by using a description of your own defined type.
The element that `parse-layout-descriptor` returns, whether explicitly or indirectly, must not be returned more than once for any layouts that are displayed at the same time.

See also
- `interpret-description`
- `define-layout`
- `layout`
- Chapter 6, “Laying Out CAPI Panes”

### password-pane

**Summary**
The password pane is a pane designed for entering passwords, such that when the password is entered it is not visible on the screen.

**Package**
capi

**Superclasses**
text-input-pane

**Initargs**
:overwrite-character
  A base-char.

**Readers**
password-pane-overwrite-character

**Description**
The password pane inherits most of its functionality from text-input-pane. It starts with the initial text and caret position specified by the arguments `text` and `caret-position` respectively, and limits the number of characters entered with the `max-characters` argument (which defaults to `nil`, meaning there is no maximum).

The password pane can be enabled and disabled with the text-input-pane accessor `text-input-pane-enabled`. overwrite-character is a base-char which is the character to display instead of the real characters. The default value of overwrite-character is #\*.
Example

(setq password-pane (capi:contain
    (make-instance
        'capi:password-pane
        :callback
        #'(lambda (password interface)
            (capi:display-message
                "Password: ~A"
                password))))
)

(capi:text-input-pane-text password-pane)

(setq password-pane
    (capi:contain
        (make-instance 'capi:password-pane
            :max-characters 5
            :text "abc"
            :overwrite-character #\$)))

(capi:password-pane-overwrite-character password-pane2)

See also
editor-pane
text-input-pane

**pinboard-layout**

Class

Summary

The class **pinboard-layout** provides two very useful pieces of functionality for displaying CAPI windows. Firstly it is a subclass of **static-layout** and so it allows its children to be positioned anywhere within itself (like a pinboard). Secondly it supports **pinboard-objects** which are rectangular areas within the layout which have size and drawing functionality.

Package
capi

Superclasses
output-pane
static-layout

Subclasses
simple-pinboard-layout

Initargs
:highlight-style
A keyword.
Description

When a `pinboard-layout` lays out its children, it positions them at the x and y specified as hints (using :x and :y), and sizes them to their minimum size (which can be specified using :visible-min-width and :visible-max-width). Objects can be moved and resized inside the `pinboard-layout` using `(setf pinboard-pane-position)` and `(setf pinboard-pane-size)`. You can find which object is the top object at a point by using `pinboard-object-at-position`.

By default, the `pinboard-layout` is made sufficiently large to accommodate all of its children, as specified by `fit-size-to-children` in the superclass `static-layout`. Note that this results in the pinboard resizing itself automatically when objects are added, removed, moved or resized. If the layout has scrollbars these are also affected. If you need the sizing capabilities, then use the class `simple-pinboard-layout` which surrounds a single child, and adopts the size constraints of that child.

The pinboard layout handles the display of pinboard objects itself by calculating which objects are visible in the region that needs redrawing, and then by calling the generic function `draw-pinboard-object` on these objects in the order that they are specified in the layout description. This means that if two pinboard objects overlap, the later one in the layout description will be on top of the other one. In other words, the description defines the Z-order for objects of type `pinboard-object`. (See the note below regarding the Z-order for objects of type `simple-pane`.)

The children of the `pinboard-layout` are defined by its `description` (inherited from `layout`). When the contents of the layout need to be manipulated while it is on the screen, it is possible to do this by using `(setf layout-description)`. However, when the change involves only `pinboard-objects`, it is much more efficient to use `manipulate-pinboard` instead. This will also cause less flickering.
Highlighting of the layout’s children by `highlight-pinboard-object` is controlled by the value of `highlight-style`, as follows:

- **:invert**: Swaps the foreground and background colors.
- **:standard**: Uses system colors.
- **:default**: Calls `draw-pinboard-object-highlighted`.

The default value of `highlight-style` is `:default`.

`record-dependent-object` can be used to record objects that need to be cleaned-up when the pinboard layout is destroyed.

### Notes

1. The `output-pane` initarg `:drawing-mode` controls quality of drawing in a `pinboard-layout`, including anti-aliasing of any text displayed on Microsoft Windows and GTK+.

2. If redrawing flickers on Microsoft Windows or Motif, perhaps because there are many pinboard objects, you can pass the `output-pane` initarg `:draw-with-buffer t`, which uses a pixmap to buffer the output before drawing it to the screen. See `output-pane` for more information.

3. `pinboard-layout` defines its own default `display-callback` (see `output-pane`), `pinboard-layout-display`. If you want to do additional drawing, see `pinboard-layout-display`.

4. Objects of type `simple-pane` are drawn directly by the windowing system and cannot be clipped relative to `pinboard-objects`, which are drawn by CAPI. Therefore `simple-panes` always appear on top in a pinboard, and their position in the `description` does not affect the Z-order.

### Example

Here are some examples of the use of pinboard objects with pinboard layouts.
(capi:contain
(make-instance
 'capi:pinboard-layout
 :description
 (list
   (make-instance
    'capi:image-pinboard-object
     :image
     (example-file "capi/graphics/Setup.bmp")
     :x 20 :y 20))
   :best-width 540 :best-height 415)

(capi:contain
(make-instance
 'capi:pinboard-layout
 :description (list
   (make-instance
    'capi:item-pinboard-object
     :text "Hello"
     :x 40 :y 10)
   (make-instance
    'capi:line-pinboard-object
     :x 10 :y 30
     :visible-min-width 100))
   :best-width 200 :best-height 200)

There are further examples here:
(example-edit-file "capi/applications/")

and here:
(example-edit-file "capi/graphics/")

This example illustrates use of draw-with-buffer t:
(example-edit-file "capi/graphics/compositing-mode")

This example shows how to draw a rectangle as the user moves the mouse to select pinboard objects:
(example-edit-file "capi/graphics/highlight-rectangle-pinboard")

There are further examples in Chapter 20, “Self-contained examples”.

724
See also "Creating graphical objects" on page 187
manipulate-pinboard
output-pane
pinboard-object
pinboard-object-at-position
pinboard-pane-position
pinboard-pane-size
record-dependent-object
redraw-pinboard-object
static-layout
"CAPI elements" on page 2
"Tooltips for output panes" on page 35

**pinboard-layout-display**

*Generic Function*

**Summary**

Draws the children of a pinboard-layout, by default.

**Package**

capi

**Signature**

pinboard-layout-display pane x y width height

**Arguments**

*pane* A pinboard-layout.

*x, y* Real numbers.

*width, height* Positive real numbers.

**Description**

The generic function *pinboard-layout-display* is the default display-callback of pinboard-layout (see output-pane for documentation of display-callback). It is responsible for the drawing of all the children of the pinboard layout.

If you want to have drawing on a pinboard-layout which is not done via the children, you can either supply your own display-callback to do the other drawing and call pinboard-layout-display (or draw-pinboard-layout-objects) to
draw the children, or subclass `pinboard-layout` and add methods to `pinboard-layout-display` specialized on your class.

In either case, if any of your drawing is "behind" the children, that is children may overlap it and need to obscure it, you need to do your drawing first and then tell the pane about it by calling `redraw-pinboard-layout` with the region that was redrawn and the optional argument `redisplay = nil`.

**Compatibility note**

In LispWorks 6.1 and earlier versions the default `display-call-back` was called `pinboard-pane-display` and was not exported, but apparently some programmers defined methods on it anyway. If you did this, you must change your method to `pinboard-layout-display` for LispWorks 7.0 and later versions.

**See also**

`pinboard-layout`
`output-pane`
`redraw-pinboard-layout`
`draw-pinboard-layout-objects`

Chapter 12, “Creating Panes with Your Own Drawing and Input”

---

**pinboard-object**

**Class**

**Summary**

Provides a rectangular area in a `pinboard-layout` with drawing capabilities.

**Package**

capi

**Superclasses**

capi-object
Subclasses:

- ellipse
- item-pinboard-object
- image-pinboard-object
- line-pinboard-object
- drawn-pinboard-object
- rectangle

Initargs:

- :pinboard The output pane on which the pinboard object is drawn.
- :activep If t, the pinboard object is made active.
- :automatic-resize A plist.
- :no-highlight A boolean.

The following initargs are geometry hints, influencing the initial size and position of a pinboard-object:

- :x The x position of the pinboard object in the pinboard.
- :y The y position of the pinboard object in the pinboard.
- :external-min-width The minimum width of the pinboard object in the pinboard.
- :external-min-height The minimum height of the pinboard object in the pinboard.
- :external-max-width The maximum width of the pinboard object in the pinboard.
The maximum height of the pinboard object in the pinboard.

The minimum visible width of the pinboard object.

The minimum visible height of the pinboard object.

The maximum visible width of the pinboard object.

The maximum visible height of the pinboard object.

The minimum width of the display region.

The minimum height of the display region.

The maximum width of the display region.

The maximum height of the display region.

The class `pinboard-object` provides a rectangular area in a `pinboard-layout` with drawing and highlighting capabilities. A pinboard object behaves just like a simple pane within layouts, meaning that they can be placed into rows, columns and other layouts, and that they size them-
selves in the same way. The main distinction is that a pin-
board object is a much smaller object than a simple pane as it
does not need to create a native window for itself.

Each pinboard object is placed into a pinboard layout (or into
a layout itself inside a pinboard layout), and then when the
pinboard layout wishes to redisplay a region of itself, it calls
the function `draw-pinboard-object` on each of the pin-
board objects that are contained in that region (in the order
that they are specified as children to the layout).

The `graphics-args` slot allows drawing options to be set. These
include the `font`, the `background` and `foreground` colors, and
others (see `graphics-state`). The `graphics-args` are used by
the built-in `pinboard-object` (all subclasses of `pinboard-
object` except `drawn-pinboard-object`) as extra arguments
in calls to drawing functions. For example, to create a filled
red rectangle object, you can use:

```
(make-instance
  'capi:rectangle
  :filled t :x 100 :y 100
  :visible-min-width 100
  :visible-min-height 100
  :graphics-args '(:foreground :red))
```

The graphics args can be accessed after creation using `pin-
board-object-graphics-args`, and it is also possible to
modify a single value using `pinboard-object-graphics-
arg`.

When `no-highlight` is `t`, CAPI does not call `draw-pinboard-
object-highlighted` even when the object is highlighted.
Typically, the drawing function you supply (either the
method `draw-pinboard-object` or the `display-callback` for
drawn-pinboard-object) will do the highlight in this case,
using `pinboard-object-highlighted-p` to check if they
need to.
The geometry hints are interpreted as described for `element`. After creation, you can query the geometry of a `pinboard-object` using the functions `static-layout-child-position` and `static-layout-child-size` and `static-layout-child-geometry`. You can also set the geometry using `cl:setf` with these functions.

By default a `pinboard-object` does not accept the input focus.

There are a number of predefined pinboard objects provided by the CAPI. They are as follows:

- `ellipse`: Draws an ellipse.
- `rectangle`: Draws a rectangle.
- `item-pinboard-object`: Draws a title.
- `line-pinboard-object`: Draws a line.
- `right-angle-line-pinboard-object`: Draws a right-angled line.
- `image-pinboard-object`: Draws an image.
- `drawn-pinboard-object`: Uses a user-defined display function.

The main user of pinboard objects in the CAPI is the graph pane, which uses `item-pinboard-object` and `line-pinboard-object` to display its nodes and edges respectively.

To force a pinboard object to redraw itself call `redraw-pinboard-object`. The redrawing may be cached and displayed at a later date.
Call the generic functions `highlight-pinboard-object` and `unhighlight-pinboard-object` to highlight a pinboard and remove its highlighting. If you want non-standard highlighting, you can implement methods for your subclass of `pinboard-object`.

You can test whether a point or region coincides with a pinboard object by the generic functions `over-pinboard-object-p` and `pinboard-object-overlap-p`. The default methods assume a rectangle based on the geometry, which must always be the enclosing rectangle of the whole pinboard object. Therefore you only need to implement methods if your subclass of `pinboard-object` has a non-rectangular shape.

`automatic-resize` makes the pinboard object resize automatically. This has an effect only if it is placed inside a `static-layout` (including subclasses like `pinboard-layout`). The effect is that when the `static-layout` is resized then the pinboard object also changes its geometry.

The value of `automatic-resize` defines how the pinboard object’s geometry changes. It must be a plist of keywords and values which match the keywords of the function `set-object-automatic-resize` and are interpreted in the same way.

Notes

You can also control automatic resizing of a pinboard object using `set-object-automatic-resize`.

Example

(example-edit-file "capi/graphics/pinboard-test")
(example-edit-file "capi/graphics/highlight-rectangle-pinboard")
(example-edit-file "capi/graphics/circled-graph-nodes")

There are further examples in Chapter 20, “Self-contained examples”.

731
pinboard-object-at-position

Generic Function

Summary
The generic function `pinboard-object-at-position` returns the uppermost pinboard object containing a specified point.

Package
capi

Signature
`pinboard-object-at-position pinboard x y`

Description
This function returns the uppermost pinboard object in the pinboard that contains the point specified by `x` and `y`. It determines this by mapping over every pinboard object within the pinboard until it finds one for which the generic function `over-pinboard-object-p` returns `t`.

Example
```
(setq pinboard
  (capi:contain
   (make-instance 'capi:pinboard-layout
                   :best-width 300
                   :best-height 300)))
```
(make-instance 'capi:item-pinboard-object
  :text "Hello world"
  :x 100 :y 100
  :parent pinboard)

(capi:pinboard-object-at-position pinboard 0 0)
(capi:pinboard-object-at-position pinboard 110 110)

See also
  over-pinboard-object-p
  pinboard-object-overlap-p
  pinboard-object
  pinboard-layout

pinboard-object-graphics-arg
  Generic Function

Summary
  Gets or sets the value of a particular drawing parameter in a
  pinboard-object.

Package
  capi

Signature
  pinboard-object-graphics-arg self keyword => value

Signature
  (setf pinboard-object-graphics-arg) value self keyword =>
  value

Arguments
  self
    A pinboard-object.

  keyword
    A keyword denoting a graphics state parameter.

Values
  value
    The value of the drawing option keyword in self.

Description
  The generic function pinboard-object-graphics-arg
  returns or sets the value of the graphics state parameter
  keyword in self.
pinboard-object-graphics-arg accesses the value in the graphics-args plist of the pinboard-object self, and (setf pinboard-object-graphics-arg) sets the value in this plist. A call to (setf pinboard-object-graphics-args) will overwrite anything set by previous calls to (setf pinboard-object-graphics-arg).

The graphics-args are used by built-in subclasses of pinboard-object.

See graphics-state for details of the drawing parameters.

See also  graphics-state
pinboard-object

pinboard-object-highlighted-p

Function

Summary
The predicate for whether a pinboard-object is in the highlighted state.

Package
capi

Signature
pinboard-object-highlighted-p pinboard-object => result

Arguments
pinboard-object  A pinboard-object.

Values
result  A boolean.

Description
The function pinboard-object-highlighted-p tests whether the argument is in the highlighted state. The state is switched by calls to highlight-pinboard-object or unhighlight-pinboard-object. In graph-pane and tracking-pinboard-layout, the state switches automatically, but in other panes it happens only by your calls to highlight-pinboard-object or unhighlight-pinboard-object.
pinboard-object-highlighted-p is useful when the draw-pinboard-object method also does the highlighting, so needs to decide if the object is highlighted or not.

pinboard-object-overlap-p

Generic Function

Summary
Tests whether a specified region overlaps with the region of a pinboard object.

Package
capi

Signature
pinboard-object-overlap-p pinboard-object top-left-x top-left-y bottom-right-x bottom-right-y => result

Description
The generic function pinboard-object-overlap-p returns true if the region of the pinboard object pinboard-object overlaps with the region specified by the other arguments.

See also
pinboard-object-at-position
over-pinboard-object-p
pinboard-object
pinboard-layout

pinboard-pane-position

Generic Function

Summary
Gets and sets the location of an object inside its parent pinboard-layout. This function is deprecated.

Package
capi

Signature
pinboard-pane-position self => x, y
setf (pinboard-pane-position self) (values x y) => x, y

Arguments
self
A pinboard-object or simple-pane.
Values  $x, y$  
The horizontal and vertical coordinates in
the pinboard-layout parent of `self`.

Description  
The generic function `pinboard-pane-position` returns as
multiple values $x, y$ the coordinates of `self` inside its parent
pinboard-layout.

There is also a `setf` expansion which sets the location of `self`
in its parent.

Example  

```lisp
(let* ((po (make-instance 'capi:item-pinboard-object
  :text "5x5" :x 5 :y 5
  :graphics-args
  '(:background :red)))
  (pl (capi:contain
        (make-instance 'capi:pinboard-layout
          :description (list po)
          :visible-min-width 200
          :visible-min-height 200))))
  (capi:execute-with-interface
   (capi:element-interface pl)
   #'(lambda (po)
       (dotimes (x 20)
         (mp:wait-processing-events 1)
         (let ((new-x (* (1+ x) 10))
                (new-y (* 5 (+ 2 x))))
             (setf (capi:item-text po)
                   (format nil "~ax~a" new-x new-y))
             (setf (capi:pinboard-pane-position po)
                   (values new-x new-y)))))
    po))
```

Notes  
`pinboard-pane-position` is deprecated, but is retained in
this version for backwards compatibility. Please use `static-
layout-child-position` instead. This does just the same.

See also  
`static-layout-child-position`
pinboard-pane-size

**Generic Function**

**Summary**
Gets and sets the size of an object inside its parent `pinboard-layout`. This function is deprecated.

**Package**
capi

**Signature**
`pinboard-pane-size self => width, height`

```lisp
(setf (pinboard-pane-size self) (values width height) => width, height)
```

**Description**
The generic function `pinboard-pane-size` returns as multiple values `width`, `height` the dimensions of `self`. There is also a `setf` expansion which sets the dimensions of `self`.

**Example**
```lisp
(let* ((po (make-instance 'capi:pinboard-object
            :x 5 :y 5
            :width 5 :height 5
            :graphics-args
            `(:background :red)))
      (pl (capi:contain
             (make-instance 'capi:pinboard-layout
                             :description (list po)
                             :visible-min-width 200
                             :visible-min-height 200)))
      (capi:execute-with-interface
        (capi:element-interface pl)
        #'(lambda(po)
            (dotimes (x 20)
              (mp:wait-processing-events 1)
              (let ((new-x (* (1+ x) 10))
                     (new-y (* 5 (+ 2 x))))
                (setf (capi:pinboard-pane-size po)
                      (values new-x new-y))))))
    po))
```

**Notes**
`pinboard-pane-size` is deprecated, but is retained in this version for backwards compatibility. Please use `static-layout-child-size` instead. This does just the same.
See also static-layout-child-size

**play-sound**  
*Function*

**Summary**  
Plays a loaded sound on Microsoft Windows and Cocoa.

**Package**  
capi

**Signature**  
`play-sound sound &key wait`

**Arguments**  
- `sound` A sound object returned by `load-sound`
- `wait` A generalized boolean.

**Description**  
The function `play-sound` plays the loaded sound `sound`.

If `wait` is true then `play-sound` will not return until `sound` has finished playing. That is, it plays the sound synchronously. The default value of `wait` is `nil`.

**Notes**

1. `:wait t` is only implemented on Microsoft Windows.
2. `play-sound` is not implemented on GTK+ and Motif.

See also `load-sound`  
`stop-sound`  
“Sounds” on page 264

**popup-confirm**  
*Function*

**Summary**  
Creates a dialog with predefined implementations of OK and Cancel buttons and a programmer-specified pane in a layout with the buttons.

**Package**  
capi
Signature

popup-confirm pane message &rest interface-args &key modal title title-font value-function exit-function apply-function apply-check apply-button ok-function ok-check ok-button no-button no-function all-button all-function cancel-button help-button help-function buttons print-function callbacks callback-type button-position buttons-uniform-size-p foreground background font screen focus owner x y position-relative-to button-container button-font continuation callback-error-handler => result, successp

Arguments

pane A CAPI pane or interface.
message A string or nil.
modal, screen, focus, owner, x, y, and position-relative-to
These are passed to display-dialog.
title A string specifying the title of the dialog window.
title-font The font used in the title.
value-function Controls the value returned, and whether a value can be returned.
ext-function Called on exiting the dialog.
apply-function, apply-check, apply-button
Define the callback, check function and title of an Apply button.
ok-function, ok-check, ok-button
Define the callback, check function and title of an OK button.
no-button, no-function
Define the title and callback of a No button.
all-button, all-function
Define the title and callback of an All button.
cancel-button Defines the title of a Cancel button.
help-button, help-function
Define the title and callback of a Help button.
buttons  Defines extra buttons.
print-function Displays ok-button, no-button, cancel-button, apply-button and all-button as button titles.
callbacks Defines callbacks for buttons.
callback-type Specifies the callback-type of buttons.
button-position One of :bottom, :top, :left, :right.
bbuttons-uniform-size-p Controls relative button sizes.
foreground, background Specify colors.
font A font or a font description.
button-font A font or a font description.
button-container A layout controlling where the buttons of the dialog appear.
continuation A function or nil.
callback-error-handler A function designator or nil.

Values

result The result of value-function, or pane, or nil.
successp nil if the dialog was cancelled, t otherwise.

Description

The function popup-confirm is the quickest way to create new dialogs. It creates a dialog with predefined implementations of buttons such as OK and Cancel and a programmer-specified pane in a layout with the buttons.

Generally the Return key selects the dialog’s OK button and the Escape key selects the Cancel button, if there is one.

The argument value-function should provide a callback which is passed pane and should return the value to return from popup-confirm. If value-function is not supplied, then pane
itself will be returned as result. If the value-function wants to indicate that the dialog cannot return a value currently, then it should return a second value that is non-nil.

The ok-check function is passed the result returned by the value-function and should return true if it is acceptable for that value to be returned. These two functions are used by popup-confirm to decide when the OK button should be enabled, thus stopping the dialog from returning with invalid data. The OK button’s state can be updated by a call to redisplay-interface on the top-level, so the dialog should call it when the button may enable or disable.

The arguments ok-button, no-button and cancel-button are the text strings for each button, or nil meaning do not include that button. The ok-button returns successfully from the dialog (with the result of value-function), the no-button means continue but return nil, and the cancel-button aborts the dialog. Note that there are clear expectations on the part of users as to the functions of these buttons — check the style guidelines of the platform you are developing for.

apply-button, if passed, specifies the title of an extra button which appears near to the OK button. apply-check and apply-function define its functionality.

all-button, if passed, specifies the title of an extra button which is always enabled and which appears near to the apply-button (if that exists) or the OK button. all-function defines its functionality.

help-button, if passed, specifies the title of a help button which appears to the right of the Cancel button. help-function defines its functionality.

print-function is called on the various button arguments to generate a string to display for each button title.

button-position specifies where to put the buttons. The default is :bottom.
buttons-uniform-size-p specifies whether the buttons are all the same size, regardless of the text on them. The default is t, but nil can be passed to make each button only as wide as its text.

foreground and background specify colors to use for the parts of the dialog other than pane, including the buttons.

font specifies the font to use in the message.

button-font specifies the font to use in the buttons.

button-container indicates where the buttons of the dialog appear. It must be a layout which is a descendant of pane. The description of this layout is automatically set to the button-panel containing the buttons.

The arguments exit-function, ok-function and no-function are the callbacks that get done when exiting, pressing OK and pressing No respectively. The exit-function defaults to exit-confirmser, the ok-function defaults to the exit-function and the no-function defaults to a function exiting the dialog with nil.

The arguments buttons, callbacks and callback-type are provided as a means of extending the available buttons. The buttons provided by buttons will be placed after the buttons generated by popup-confirmser, with the functions in callbacks being associated with them. Finally callback-type will be provided as the callback type for the buttons.

If any of callbacks need to access pane, you could use confirmser-pane together with a callback-type that passes the interface.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by popup-confirmser. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet.
and **popup-confirm**er returns immediately, leaving the dialog on the screen. The **with-dialog-results** macro provides a convenient way to create a *continuation* function.

**callback-error-handler**, if non-nil, should be a function designator for a function of one argument which is a condition, like the **handler-function** in **cl:handler-bind**. The handler is established (by **cl:handler-bind** with type **cl:error**) around each callback call inside the scope of **popup-confirm**er or **display-dialog**. In recursive calls, only the handler of the innermost call to **popup-confirm**er or **display-dialog** is established.

**callback-error-handler** can use **current-popup** to find the popup (first argument to the innermost call of **display-dialog** or **popup-confirm**er).

If **callback-error-handler** wants to do a non-local exit, it should either call **abort-callback** to abort the callback but leave the dialog, or **exit-dialog** (or **abort-dialog**) to exit (or abort) the dialog.

All other arguments will be passed to the call to **make-instance** for the interface that will be displayed using **display-dialog**. Thus geometry information, colors, and so on can be passed in here as well. By default, the dialog will pick up the *foreground*, *background* and *font* of *pane*.

**Notes**

1. On Microsoft Windows and Motif, the effect of **callback-error-handler** can be achieved by using **cl:handler-bind** around the call to **display-dialog** or **popup-confirm**er (the handler will also handle errors during raising the dialog, but these are not expected to happen). On Cocoa, using such an error handler does not necessarily work, because the callback may happen in another process. **callback-error-handler** ensures that the callback is in the scope of the handler on all platforms. From the same reason the handler should not rely on the dynamic environment.
(including catchers and restarts), and needs to use `current-popup` to find its "context" and use `abort-callback`, `exit-dialog` or `abort-dialog` for non-local exit.

2. If the callback itself calls `popup-confirmer` or `display-dialog`, the `callback-error-handler` handler will stay until the callback returns. Unless the recursive call handles the error, the handler of the outer call may be called to handle it, and needs to be written to deal with this possibility correctly. If the handler inside a recursive call needs to access the popup that was used in the same call that the handler was used, it should close over it, because `current-popup` returns the innermost one.

3. A handler that is established by the callback (by `cl:handler-bind` or `cl:handler-case`) is inside the scope of the `callback-error-handler`, and therefore will be called first.

Example

Here are two simple examples which implement the basic functionality of two CAPI prompters: the first implements a simple `prompt-for-string`, while the second implements `prompt-for-confirmation`.

(capi:popup-confirmer
  (make-instance 'capi:text-input-pane
    :callback
      'capi:exit-confirmer)
  "Enter some text:" 
  :value-function 'capi:text-input-pane-text)

(capi:popup-confirmer nil
  "Yes or no?"
  :callback-type :none
  :ok-button "Yes" 
  :no-button "No"
  :cancel-button nil
  :value-function #'(lambda (dummy) t))

This example demonstrates the use of 
:redeisplay-interface to make the OK button enable and disable on each keystroke.
(defun pane-integer (pane)
  (ignore-errors (values
                   (read-from-string
                    (capi:text-input-pane-text
                     pane)))))

(capi:popup-confirmed
 (make-instance 'capi:text-input-pane
               :callback 'capi:exit-confirmed
               :change-callback :redisplay-interface)
  "Enter an integer"
  :value-function 'pane-integer
  :ok-check 'integerp)

An example illustrating the use of :button-container:

(let* ((bt (make-instance 'capi:simple-layout
                          :title "Button Container"
                          :title-position :left))
        (tip1 (make-instance 'capi:text-input-pane
                             :title "Top"))
        (tip2 (make-instance 'capi:text-input-pane
                             :title "Bottom"))
        (layout (make-instance 'capi:column-layout
                             :description
                             (list tip1
                                    bt
                                    tip2)))
  (capi:popup-confirmed layout nil
                         :title
                         "Dialog using button-container"
                         :button-container bt))

An example with all the defined buttons in use:
(defun all-buttons-dialog (&optional (num 20))
  (let ((pane
         (make-instance 'capi:list-panel
           :items
           (loop for ii from 1
                 to num
                 collect
                 (format nil "~r" ii))
           :visible-min-width '(character 20)))))

(capi:popup-confirm
 pane
 "All Buttons"
 :callback-type :none
 :button-position :right
 :cancel-button "Cancel Button"
 :ok-button "OK Button"
 :ok-function #'(lambda (x)
                  (declare (ignore x))
                  (capi:exit-dialog
                   (capi:choice-selected-item pane)))
 :no-button "No Button"
 :no-function
 #'(lambda ()
    (capi:exit-dialog
     (cons :no
           (capi:choice-selected-item pane))))
 :apply-button "Apply Button"
 :apply-function
 #'(lambda ()
    (capi:display-message
     "Applying to ~a"
     (capi:choice-selected-item pane)))
 :help-button "Help Button"
 :help-function
 #'(lambda ()
    (capi:display-message
     "~a is ~: [an odd- ; an even-] number"
     (capi:choice-selected-item pane)
     (oddp (capi:choice-selection pane)))))

:all-button "All Button"
 :all-function
 #'(lambda ()
    (capi:exit-dialog
     (capi:collection-items pane)))))))

(all-buttons-dialog)
A dialog with arbitrary buttons:

(capi:popup-confirmeder
 (make-instance 'capi:text-input-pane)
 "Dialog with arbitrary buttons"
 :buttons '(:abc :xyz)
 :callbacks
 (list #'(lambda (data)
           (capi:display-message
              "Button -A was pressed" data))
       #'(lambda (data)
           (capi:display-message
              "Button with -A was pressed, exiting with
 -S" data data)
       (capi:exit-dialog data)))
 :callback-type :data)

This example illustrates the use of callback-error-handler:
(defun my-error-handler (condition)
  (let ((pane (capi:current-popup)))
    (capi:display-message
     "Error inside dialog: -a : -a"
     (capi:capi-object-name pane)
     condition)
    (capi:abort-callback)))

(let*
  ((foo-callback
     (lambda ()
       (let ((md (make-instance
                   'capi:push-button
                   :text "Error inside Callback-Error-Handler"
                   :name "Chicken"
                   :callback-type :data
                   :data "Twisted ankle."
                   :callback 'error)))
        (capi:popup-confirmer
         md nil
         :callback-error-handler 'my-error-handler)))))
  (foo (make-instance
         'capi:push-button
         :text "Popup confirmer with Callback-Error-Handler"
         :callback-type :none
         :callback foo-callback))
  (bar (make-instance
         'capi:push-button
         :text "Error without a handler"
         :callback-type :data
         :data "Broken leg."
         :callback 'error)))))
  (capi:contain (list foo bar)))

See also

abort-dialog
abort-exit-confirmer
confirmer-pane
display-dialog
exit-confirmer
exit-dialog
Chapter 11, “Dialogs: Prompting for Input”
**popup-menu-button**

**Class**

Summary
A button with a popup menu.

Package
**capi**

Superclasses
**item**

Initargs
- **:menu** A menu or nil.
- **:menu-function** A function designator or nil.

Accessors
- **popup-menu-button-menu**
- **popup-menu-button-menu-function**

Description
The class **popup-menu-button** provides a button with a popup menu, which is displayed when the user clicks on the button.

If **menu-function** is non-nil, it should be function of one argument (the pane) and should return a menu object. Otherwise, **menu** should be a menu object.

**popup-menu-button** inherits from **item**, so you can supply text, data and so on.

Example
(example-edit-file "capi/elements/popup-menu-button")

See also
**menu**

**popup-menu-force-popdown**

**Function**

Summary
Cancels a popup menu.

Package
**capi**
Signature  
popup-menu-force-popdown  

Arguments  
popup-menu  
A menu displayed using display-popup-menu.

Values  
result  
A boolean.

Description  
The function popup-menu-force-popdown cancels the menu popup-menu if it is currently displayed.

popup-menu should be a popup menu, that is a menu that is displayed using display-popup-menu. popup-menu-force-popdown pops it down, in the same way that pressing Cancel would normally do.

popup-menu-force-popdown can be called from any process. In particular, it can be called from a timer without worrying on which process it is actually executed. For examples of using timers in CAPI, see “Examples using timers to implement "animation"” on page 279.

If popup-menu is not displayed, popup-menu-force-popdown has no effect.

The result is t if the menu is displayed when popup-menu-force-popdown is called. Otherwise result is nil.

Notes  
popup-menu-force-popdown can be called from any process.

See also  
display-popup-menu
menu
“Displaying menus programmatically” on page 123

*ppd-directory*  

Variable

Summary  
The directory in which LispWorks looks for PPD files.

Package  
capi
Initial value  
nil

Description  
The variable *ppd-directory* specifies where LispWorks looks for PostScript Printer Definition (PPD) files.  
This applies only on Motif.  
The directory which is the value of *ppd-directory* should contain PPD files (files with extension ppd) either directly, or under subdirectories. The PPD files under each subdirectory are grouped together, with the name of the directory as the group name. PPD files in *ppd-directory* itself are grouped under the "Other" group.

See also  
"Printing on Motif" on page 252

---

print-capi-button  
Generic Function

Summary  
Generates the text for a button.

Package  
capi

Signature  
print-capi-button button => text

Arguments  
button  
A button.

Values  
text  
A string.

Description  
The generic function print-capi-button is used to generate the text for a button.  
You can add methods for your own button classes.

See also  
button
print-collection-item

Generic Function

Summary
Prints an item as a string.

Package
capi

Signature
print-collection-item item collection

Arguments
item An item or an Lisp object.
collection A collection or any Lisp object.

Description
The generic function print-collection-item prints item as a string. It is used when item is known to be an item in collection.

An item in a collection prints using the first of these which returns non-nil: the item’s text, the item’s print-function, the collection’s print-function or the item’s data. An item not known to be in the collection is printed simply using print-object.

The method on (t collection) uses the collection’s print-function.

Example
(setq collection (make-instance 'capi:collection :items '(1 2 3 4 5) :print-function #'(lambda (x) (format nil "<-A:>
  x)))))

(capi:print-collection-item 2 collection)

In this example we provide our own print-collection-item method:
(defclass my-tree-view (capi:tree-view) ()
)

(defmethod capi:print-collection-item ((item capi:item) (tree my-tree-view))
  (string-capitalize (svref (capi:item-data item) 0)))

(capi:contain
 (make-instance 'my-tree-view :roots
   (list (make-instance 'capi:item :data
       (vector "foo"))))
)

See also get-collection-item collection

print-dialog  Function

Summary Displays a print dialog and returns a printer object.

Package capi

Signature print-dialog &key screen owner first-page last-page print-selection-p print-pages-p print-copies-p continuation => printer

Values printer A printer, or nil.

Description The function print-dialog displays a print dialog and returns a printer object. The printer object returned will print multiple copies if requested by the user.

If print-pages-p is t, the user can select a range of pages to print. This should always be the case unless the application only produces single page output. If print-pages is t, first-page and last-page can be used to initialize the page range. For example, they could be set to be the first and last pages of the document.
The print-copies-p argument indicates whether the application handles production of multiple copies for drivers that do not support this function. Currently this should be nil if the application uses Page Sequential printing and t if the application uses Page on Demand printing.

If print-selection-p is t, the user is given the option of printing the current selection. Only specify this if the application has a notion of selection and selecting printing functionality is provided.

The dialog is displayed on the current screen unless screen specifies otherwise.

owner specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If continuation is non-nil, then it must be a function with a lambda list that accepts one argument. The continuation function is called with the values that would normally be returned by print-dialog. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and print-dialog returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

Note that the printer object itself is opaque but programmatic setting of some printer options is available via the function set-printer-options.

Examples

(ex example-edit-file "capi/graphics/metafile")
(ex example-edit-file "capi/printing/fit-to-page")
(ex example-edit-file "capi/printing/multi-page")
(ex example-edit-file "capi/printing/page-on-demand")
See also  
print-file
print-text
set-printer-options
Chapter 11, “Dialogs: Prompting for Input”
“Printing from the CAPI—the Hardcopy API” on page 249

print-editor-buffer

Function

Summary  
Prints the contents of an editor buffer to the printer.

Package  
capi

Signature  
print-editor-buffer buffer &key start end printer interactive font

Description  
The function print-editor-buffer prints the contents of buffer to printer, which is the current printer by default.

By default the entire editor buffer is printed, but by specifying start and end to be editor points, a part of the buffer can be printed. See the LispWorks Editor User Guide for information about editor points.

If interactive is t, the default value, then a printer dialog is displayed.

font is interpreted as described for print-text.

See also  
print-file
print-text
Chapter 11, “Dialogs: Prompting for Input”
“Printing from the CAPI—the Hardcopy API” on page 249

print-file

Function

Summary  
Prints the contents of a specified file.
Package `capi`

Signature `print-file file &key printer interactive font`

Description The function `print-file` prints `file` to `printer`, which defaults to the current printer. If `interactive` is `t`, then a print dialog is displayed. This is the default behavior.

`font` is interpreted as described for `print-text`.

See also `print-editor-buffer`
`print-text`

“Printing from the CAPI—the Hardcopy API” on page 249

---

**`print-rich-text-pane`**

Function

Summary Prints the contents of a `rich-text-pane`, on Microsoft Windows.

Package `capi`

Signature `print-rich-text-pane pane &key jobname printer interactive selection => result`

Arguments

- `pane` A `rich-text-pane`.
- `jobname` A string, or `nil`.
- `printer` A printer, or `nil`.
- `interactive` A boolean.
- `selection` A boolean.

Values `result` A boolean.

Description The function `print-rich-text-pane` prints the contents in `pane`. 
jobname is the name of the print job. The default value is \texttt{nil}, meaning that the name "Document" is used.

printer is the printer to use. The default value is \texttt{nil}, meaning that the \texttt{current-printer} is used.

interactive, if true, specifies that a \texttt{print-dialog} is displayed before printing. The default value of \texttt{interactive} is \texttt{t}.

selection is a boolean specifying what to print. If true, only the current selection is printed. If \texttt{nil}, all the contents of pane are printed. The default value is \texttt{nil}.

Notes \texttt{print-rich-text-pane} is supported only on Microsoft Windows.

See also \texttt{rich-text-pane}
“Printing from the CAPI—the Hardcopy API” on page 249

**print-text**

*Function*

**Summary**
Prints plain text to a printer.

**Package**
capi

**Signature**
\texttt{print-text line-function &key printer tab-spacing interactive font}

**Description**
The function \texttt{print-text} prints plain text to a printer specified by \texttt{printer}, and defaulting to the current printer.

The \texttt{line-function} is called repeatedly with no arguments to enumerate the lines of text. It should return \texttt{nil} when the text is exhausted.

The \texttt{tab-spacing} argument, which defaults to 8, specifies the number of spaces printed when a tab character is encountered.
print-text starts a new page when a line consisting of just a formfeed character (ASCII 12) is found in the text.

If interactive is t, then a print dialog is displayed. This is the default behavior.

font should be a gp:font object, or a Font Description object, or a symbol which is a font alias as defined by define-font-alias. The printed text is line wrapped on the assumption that the font is fixed width, so be sure to pass a suitable font. The default value of font is a Font Description for a fixed pitch font of size 10.

See also
print-editor-buffer
print-file
“Printing from the CAPI—the Hardcopy API” on page 249

printer-configuration-dialog

Function

Summary Displays a dialog allowing the user to configure printers.

Package capi

Signature printer-configuration-dialog &key screen owner

Description The function printer-configuration-dialog displays the printer configuration dialog that allows users to add and configure PostScript printers.

This applies only on Motif.

The screen argument specifies a CAPI screen on which to display the dialog. The owner argument controls which interface owns the dialog. If it is specified it should be a currently displayed CAPI interface; it defaults to the current top level interface.
The general options that are available are described under `install-postscript-printer`. In addition, printer-specific options (which are defined in the printer PPD file) are available.

The printers that are visible in the dialog are defined by files in the directories in the list `*printer-search-path*`.

See also

- `install-postscript-printer`
- `*printer-search-path*`
- “Printing on Motif” on page 252

**printer-metrics**

*Structure Class*

**Summary**
The type of objects containing printer metrics.

**Package**
capi

**Description**
A `printer-metrics` object is returned by `get-printer-metrics`. The readers for the slots of a `printer-metrics` object are described below.

`printer-metrics-device-height` and `printer-metrics-device-width` respectively return the height and width of the printable page in the internal units used by the printer driver or printing subsystem of the printer. These functions should not be used to determine the aspect ratio of the printable page as some printers have size units that differ in the x and y directions.

`printer-metrics-dpi-x` and `printer-metrics-dpi-y` return the number of printer device units per inch in the x and y directions respectively. This typically corresponds to the printer resolution, although in some cases this may not be known. For example, a generic PostScript language compatible driver might always return 300dpi, even though it cannot know the resolution of the printer the PostScript file will actually be printed on.
printer-metrics-height and printer-metrics-width respectively return the height and width of the printable area in millimeters.

printer-metrics-left-margin and printer-metrics-top-margin respectively return the current left margin and current top margin of the printable area in millimeters.

printer-metrics-max-height and printer-metrics-max-width respectively return the greatest possible height and width of the printable area in millimeters.

printer-metrics-min-left-margin and printer-metrics-min-top-margin respectively return the smallest possible left margin and top margin of the printable area in millimeters.

printer-metrics-paper-height and printer-metrics-paper-width respectively return the height and width of the paper selected for this printer in millimeters.

See also

get-printer-metrics

“Printing from the CAPI—the Hardcopy API” on page 249

**printer-port**

**Class**

**Summary**

An object that **with-print-job** uses when a pane is not supplied.

**Package**

capi

**Description**

The class **printer-port** is the class of the object that **with-print-job** binds its **var** argument to when it is not given a pane.
**printer-port** is a graphics port, which is described in Chapter 13, “Drawing - Graphics Ports” and Chapter 22, “GRAPHICS-PORTS Reference Entries”.

**Notes**

The phrase “printer port” refers to either to an instance of **printer-port** or an instance of **output-pane** when it is used as the pane argument to with-printer-job.

**See also**

**output-pane**

**with-print-job**

---

**printer-port-handle**

*Function*

**Summary**

Returns the underlying handle to a printer port.

**Package**

capi

**Signature**

printer-port-handle &optional port => handle

**Arguments**

*port*  
A printer port.

**Values**

*handle*  
Platform-dependent.

**Description**

The function **printer-port-handle** returns a platform-dependent value which represents the underlying handle to the printer port.

On Microsoft Windows, *handle* is the HDC for the printer device.

If *port* is passed it should be the value bound to *var* in **with-print-job**. If *port* is not supplied it defaults to the current printer port (dynamically bound within **with-print-job**).

**See also**

**with-print-job**

“Printing from the CAPI—the Hardcopy API” on page 249
printer-port-supports-p  

**Function**

Summary  
Detects if the printer port can support a certain feature.

Package  
capi

Signature  
printer-port-supports-p feature &optional port => supportedp, validp

Arguments  
feature  
A keyword.

port  
A printer port.

Values  
supportedp  
A boolean.

validp  
A boolean.

Description  
The function printer-port-supports-p detects if the printer port can support the feature named by feature.

If port is passed it should be the value bound to var in with-print-job. If port is not supplied it defaults to the current printer port (dynamically bound within with-print-job).

supportedp indicates if the feature is supported.

validp indicates if the feature was recognized.

Currently the only value of feature that is recognized is :postscript and the supportedp value is true if the printer supports PostScript.

See also  
with-print-job
“Printing from the CAPI—the Hardcopy API” on page 249

---

*printer-search-path*  

**Variable**

Summary  
Specifies where to look for printer definition files.

Package  
capi
Initial value

("-/lispworks-printers/" nil)

Description

The variable *printer-search-path* specifies where to look for printer definition files.

This applies only on Motif.

The value is a list containing directory pathname designators specifying where to look for printer definition files. The list can also include the value nil, which is interpreted as the printers directory in the LispWorks library.

To find known printers the system loads all files in these directories. If there are duplicate printer definitions, the printer in the first directory takes precedence.

The default path is useful when printing from the Common LispWorks IDE, but applications that want to allow users to use printers should set the list appropriately.

The first path in the *printer-search-path* list is regarded as the "local" path. New printers are saved in this path. When the user edits a printer that was found in another directory on *printer-search-path* and then tries to save it, the system prompts for whether to overwrite the original or save it in the "local" directory.

The printer files can be copied to other directories, on the same machine, and hence to install printers in different directories.

A printer file can be copied to other machines, provided the printer is installed on the other machine and the PPD file is available in the same path.

See also

“Printing on Motif” on page 252.

process-pending-messages

Function

Summary

Processes all the pending messages in the current process.
### process-pending-messages

**Package**  
capi

**Signature**  
process-pending-messages ignored => nil

**Arguments**  
The single argument is ignored.

**Description**  
The function process-pending-messages processes all the pending messages in the current process, and then returns nil. It is useful when your code needs to continuously do something, but also needs to respond to user input or other messages.

**See also**  
“The correct thread for CAPI operations” on page 39

### progress-bar

**Class**

**Summary**  
A pane that is used to show progress during a lengthy task.

**Package**  
capi

**Superclasses**  
range-pane  
titled-object  
simple-pane

**Description**  
This pane is used to display progress during a lengthy task. It has no interactive behavior.

The range-pane accessors (setf range-start) and (setf range-end) are used to specify integers delimiting the range of values the progress bar can display.

The accessor (setf range-slug-start) is used to set an integer value for the progress indicator.

**Examples**  
(example-edit-file "capi/elements/progress-bar")

(example-edit-file "capi/elements/progress-bar-from-background-thread")
prompt-for-color

Function

See also range-pane
titled-object
“Slider, Progress bar and Scroll bar” on page 29

Summary

Presents a dialog box allowing the user to choose a color.

Package
capi

Signature

prompt-for-color message &key color colors owner => result, successp

Arguments

message A string.
color A color specification.
colors A list.
owner An owner window.

Values

result A color specification, or nil.
successp A boolean.

Description

The function prompt-for-color pops up a dialog box allowing the user to choose a color.

message supplies a title for the dialog on GTK+ and Motif. On Microsoft Windows message is ignored.

color provides the default color in the dialog.

colors is a list of custom color specifications that the user can choose from.

owner specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

Notes

For a description of color specifications, see “Color specs” on page 243.
See also Chapter 11, “Dialogs: Prompting for Input”

**prompt-for-confirmation**

*Function*

**Summary**
Displays a dialog box with a message and Yes and No buttons.

**Package**
capi

**Signature**
prompt-for-confirmation message &key screen owner cancel-button default-button continuation => result, successp

**Arguments**
- message A string.
- screen A screen.
- owner An owner window.
- cancel-button A boolean.
- default-button A keyword, or nil.
- continuation A function or nil.

**Values**
- result A boolean.
- successp A boolean.

**Description**
The function `prompt-for-confirmation` displays a dialog box containing message, with Yes and No buttons. When either Yes or No is pressed, it returns two values:

- A boolean indicating whether Yes was pressed.
- t (for compatibility with other prompt functions).

`cancel-button` specifies whether a Cancel button also appears on the dialog. When Cancel is pressed, `abort` is called and the dialog is dismissed. The default value of `cancel-button` is `nil`. 
default-button specifies which button has the input focus when the dialog appears (and is thus selected when the user immediately presses Return). The value :ok means Yes, the value :cancel means Cancel, and any other value means No. The default value of default-button is nil.

owner specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by prompt-for-continuation. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-for-confirmation returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

Example

(capi:prompt-for-confirmation "Continue?"

(multiple-value-bind (res success)
  (capi:prompt-for-confirmation "Yes, No or Cancel" :cancel-button t)
  (if success res (abort)))

See also confirm-yes-or-no

Chapter 11, “Dialogs: Prompting for Input”

prompt-for-directory Function

Summary Displays a dialog prompting the user for a directory.

Package capi
Signature  

```
prompt-for-directory message &key if-does-not-exist pathname file-package-is-directory pane-args popup-args owner continuation => result, successp
```

Arguments  

- **message**  
  A string.

- **if-does-not-exist**  
  One of :ok, :prompt or :error.

- **pathname**  
  A pathname, or nil.

- **file-package-is-directory**  
  A generalized boolean.

- **pane-args**  
  Arguments to pass to the pane.

- **popup-args**  
  Arguments to pass to the confirmer.

- **owner**  
  An owner window.

- **continuation**  
  A function or nil.

Values  

- **result**  
  A directory pathname, or nil.

- **successp**  
  A boolean.

Description  

The function `prompt-for-directory` prompts the user for a directory pathname using a dialog box. Like all the prompters, `prompt-for-directory` returns two values: the directory pathname and a flag indicating success. The `successp` flag will be nil if the dialog was cancelled, and t otherwise.

On Windows and Motif, if `if-does-not-exist` is :ok, a non-existent directory can be chosen. When set to :prompt, if a non-existent directory is chosen, the user is prompted for whether the directory should be created. When set to :error, the user cannot choose a non existent directory. The default value of `if-does-not-exist` is :prompt.

On Cocoa it is never possible to choose a non-existent directory, and the value of `if-does-not-exist` is ignored.

`pathname`, if non-nil, supplies an initial directory for the dialog. The default value for `pathname` is nil, and with this value the dialog initializes with the current working directory.
file-package-is-directory is handled as by prompt-for-file.

owner specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by prompt-for-directory. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-for-directory returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

The prompt itself is created by passing an appropriate pane to popup-confirm. Arguments can be passed to the make-instance of the pane and the call to popup-confirm using pane-args and popup-args respectively. Currently, the pane used to create the file prompter is internal to the CAPI.

See also popup-confirm
prompt-for-file
Chapter 11, “Dialogs: Prompting for Input”

prompt-for-file

Function

**Summary**

Displays a dialog prompting the user for a filename.

**Package**

capi

**Signature**

prompt-for-file message &key pathname ok-check filter filters if-exists if-does-not-exist file-package-is-directory operation owner pane-args popup-args continuation => filename, successp, filter-name

**Arguments**

message A string or nil.

pathname A pathname designator or nil.
ok-check  A function or \texttt{nil}.
filter  A string or \texttt{nil}.
filters  A property list.
if-exists  One of \texttt{:ok} or \texttt{:prompt}.
if-does-not-exist  One of \texttt{:ok}, \texttt{:prompt} or \texttt{:error}.
file-package-is-directory  A generalized boolean.
operation  One of \texttt{:open} or \texttt{:save}.
owner  An owner window.
continuation  A function or \texttt{nil}.

Values

filename  A pathname or \texttt{nil}.
successp  A boolean.
filter-name  A string.

Description

The function \texttt{prompt-for-file} prompts the user for a file using a dialog box.

\texttt{pathname}, if non-nil, is a pathname designator providing a default filename for the dialog.

\texttt{ok-check}, if non-nil, should be a function which takes a pathname designator argument and returns a true value if the pathname is valid.

\texttt{filter} specifies the initial filter expression. The default value is \texttt{"*.*"}. An example filter expression with multiple filters is \texttt{"*.LISP;*.LSP"}.

\texttt{filter} is used on all platforms. However on Motif, if \texttt{filter} contains multiple file types, only the first of these is used.
On Cocoa `prompt-for-file` supports the selection of application bundles as files if they match the filter. For example, they will match if the filter expression contains `*.app` or `*.*`.

*filters* is a property list of filter names and filter expressions, presenting filters which the user can select in the dialog. If the *filter* argument is not one of the expressions in *filters*, an extra filter called "Files" is added for this expression.

On Microsoft Windows the default value of *filters* is:

```lisp
("Lisp Source Files" "*.LISP;*.LSP"
 "Lisp Fasls" "*.OFASL"
 "Text Documents" "*.DOC;*.TXT"
 "Image Files" "*.BMP;*.DIB;*.ICO;*.CUR"
 "All Files" "*.*")
```

The "Lisp Fasls" extension may vary depending on the implementation.

On Cocoa and GTK+ the default value of *filters* is:

```lisp
("Lisp Source Files" "*.lisp;*.lsp"
 "Text Documents" "*.txt;*.text"
 "All Files" "*.*")
```

*filters* is ignored on Motif.

When *if-exists* is :ok, an existing file can be returned. Otherwise the user is prompted about whether the file can be overwritten. The default for *if-exists* is :ok when *operation* is :open and :prompt when *operation* is :save.

When *if-does-not-exist* is :ok, a non-existent file can be chosen. When it is :prompt, the user is prompted if a non-existent file is chosen. When it is :error, the user cannot choose a non-existent file. The default for *if-does-not-exist* is :prompt if *operation* is :open and :ok if *operation* is :save.

*operation* chooses the style of dialog used, in LispWorks for Windows only. The default value is :open.
owner, if non-nil, specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

If continuation is non-nil, then it must be a function with a lambda list that accepts three arguments. The continuation function is called with the values that would normally be returned by prompt-for-file. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-for-file returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

On Motif, the prompt itself is created by passing an appropriate pane to popup-confirm. Arguments can be passed to the make-instance of the pane and the call to popup-confirm using pane-args and popup-args respectively. Currently, the pane used to create the file prompter is internal to the CAPI, pane-args and popup-args are ignored on Microsoft Windows.

filename is the full pathname of the file selected, or nil if the dialog was cancelled.

successp is a flag which is nil if the dialog was cancelled, and t otherwise.

On Microsoft Windows prompt-for-file returns a third value: filter-name is the name of the filter that was selected in the dialog.

file-package-is-directory controls how to treat file packages on Cocoa. By default it is nil, which means that a file package is treated as file. If file-package-is-directory is non-nil, the a file package is treated as a directory. file-package-is-directory corresponds to the treatsFilePackagesAsDirectories method of NSSavePanel in Cocoa. It has no effect on other platforms.

Example

(capi:prompt-for-file "Enter a filename:")

(capi:prompt-for-file "Enter a filename:
    :pathname "/usr/bin/cal")
See also

popup-confirmer
prompt-for-string
prompt-for-directory
Chapter 11, “Dialogs: Prompting for Input”

prompt-for-files

Function

Summary
Displays a dialog which returns multiple filenames.

Package
capi

Signature
prompt-for-files message &key pathname ok-check filter filters
if-exists if-does-not-exist file-package-is-directory operation owner
pane-args popup-args continuation => filenames, successp, filter-name

Values
filenames A list.
successp A boolean.
filter-name A string.

Description
The function prompt-for-files presents the user with a
dialog box similarly to prompt-for-file, but in which
multiple filenames can be selected.

The arguments are as for prompt-for-file, except on
Microsoft Windows where the default value of filters is:

("MS Word files" "*.doc"
 "HTML files" "*.htm;*.html"
 "Plain Text files" "*.txt;*.text"
 "All files" "*.*")

On Cocoa and GTK+ the default value of filters is:

("Lisp Source Files" "*.lisp;*.lsp"
 "Text Documents" "*.txt;*.text"
 "All Files" "*.*")
which is the same default as for \texttt{prompt-for-file}.

\textit{filenames} is a list of filenames, or \texttt{nil} if the user cancels the dialog.

\textit{successp} is a flag which is \texttt{nil} if the dialog was cancelled, and \texttt{t} otherwise.

\textit{filter-name} is the name of the filter that was selected in the dialog.

If \textit{continuation} is non-nil, then it must be a function with a lambda list that accepts three arguments. The \textit{continuation} function is called with the values that would normally be returned by \texttt{prompt-for-files}. On Cocoa, passing \textit{continuation} causes the dialog to be made as a window-modal sheet and \texttt{prompt-for-files} returns immediately, leaving the dialog on the screen. The \texttt{with-dialog-results} macro provides a convenient way to create a \textit{continuation} function.

Notes

\texttt{prompt-for-files} is not implemented on Motif.

See also

\texttt{prompt-for-file}

\section*{prompt-for-font}

\textbf{Function}

\textbf{Summary}

Presents a dialog box allowing the user to choose a font.

\textbf{Package}

capi

\textbf{Signature}

\texttt{prompt-for-font message &key font owner => result, successp}

\textbf{Arguments}

\begin{itemize}
  \item \textit{message} \quad A string.
  \item \textit{font} \quad A font, a font description, or \texttt{nil}.
  \item \textit{owner} \quad An owner window, or \texttt{nil}.
\end{itemize}

\textbf{Values}

\begin{itemize}
  \item \textit{result} \quad A font, or \texttt{nil}.
successp  A boolean.

Description  The function prompt-for-font displays a dialog box allowing the user to choose a font.

message supplies a title for the dialog.

font, if non-nil, provides defaults for the dialog box. The default value is nil.

owner specifies an owner window for the dialog. See Chapter 11, “Dialogs: Prompting for Input” for details.

For a description of Graphics Ports fonts and font descriptions, see “Portable font descriptions” on page 217.

See also  find-best-font
Chapter 11, “Dialogs: Prompting for Input”

prompt-for-form  Function

Summary  Displays a text input pane and prompts the user for a form.

Package  capi

Signature  prompt-for-form message &key package initial-value evaluate quotify ok-check value-function pane-args popup-args continuation => result, okp

Description  The function prompt-for-form prompts the user for a form by providing a text input pane that the form can be typed into.

The form is read in the package if specified or *package* if not. If evaluate is non-nil then the result is the evaluation of the form, otherwise it is just the form itself. The printed version of initial-value will be placed into the text input pane as a default, unless quotify, which defaults to evaluate, specifies otherwise. If value-function is provided it overrides the
default value function which reads the form and evaluates it when required. If the ok-check is provided it will be passed the entered form and should return \texttt{t} if the form is a valid result.

If \textit{continuation} is non-nil, then it must be a function with a lambda list that accepts two arguments. The \textit{continuation} function is called with the values that would normally be returned by \texttt{prompt-for-form}. On Cocoa, passing \textit{continuation} causes the dialog to be made as a window-modal sheet and \texttt{prompt-for-form} returns immediately, leaving the dialog on the screen. The \texttt{with-dialog-results} macro provides a convenient way to create a \textit{continuation} function.

The prompter is created by calling \texttt{prompt-for-string}. Arguments can be passed to the \texttt{make-instance} of the pane and the call to \texttt{popup-confirmer} using \texttt{pane-args} and \texttt{popup-args} respectively, and an input history can be implemented by supplying a \texttt{history-function} or \texttt{history-symbol} in \texttt{popup-args}.

\textbf{Example}

Try the following examples, and each time enter \((+ 1 2)\) into the input pane.

\begin{verbatim}
(capi:prompt-for-form "Enter a form:"
(capi:prompt-for-form "Enter a form:" :evaluate nil)
\end{verbatim}

\textbf{See also} \newline
\texttt{prompt-for-forms} \newline
\texttt{prompt-for-string} \newline
\texttt{popup-confirmer} \newline
\texttt{text-input-pane} \newline
Chapter 11, “Dialogs: Prompting for Input”

\textbf{prompt-for-forms}

\textit{Function}

\textbf{Summary}

Displays a text input pane prompting the user for a number of forms.

\textbf{Package} \newline\texttt{capi}
The function `prompt-for-forms` prompts the user for a number of forms by providing a text input pane that the forms can be typed into, and it returns the forms in a list. The forms are read in the specified `package` or `*package*` if not. If `evaluate` is non-nil then the result is the evaluation of the form, else it is just the form itself.

The printed version of `initial-value` will be placed into the text input pane as a default.

If `continuation` is non-nil, then it must be a function with a lambda list that accepts two arguments. The `continuation` function is called with the values that would normally be returned by `prompt-for-forms`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `prompt-for-forms` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.

The prompter is created by passing an appropriate pane (in this case a text input pane) to `popup-confirm`. Arguments can be passed to the `make-instance` of the pane and the call to `popup-confirm` using `pane-args` and `popup-args` respectively.

Try the following example, and enter 1 2 3 into the input pane.

(capi:prompt-for-forms "Enter some forms:")

See also

- `prompt-for-form`
- `prompt-for-string`
- `popup-confirm`
- `text-input-pane`
prompt-for-integer

Function

Summary
Prompts the user for an integer.

Package
capi

Signature
prompt-for-integer message &key min max initial-value ok-check pane-args popup-args continuation => result, successp

Arguments
message A string.
min An integer or nil.
max An integer or nil.
initial-value An integer or nil.
ok-check A function or nil.
pane-args Arguments to pass to the pane.
popup-args Arguments to pass to the confirmer.
continuation A function or nil.

Description
The function prompt-for-integer pops up a text-input-pane and prompts the user for an integer, which is returned in result.

When min or max are specified the allowable result is constrained accordingly.

initial-value determines the initial value displayed in the dialog. initial-value defaults to the value of min, or if min is nil then no initial value is displayed.

Further restrictions can be applied by passing an ok-check function. ok-check should take one argument, the currently entered number, and should return t if it is valid. If ok-check is nil (the default) then there is no further restriction.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be
returned by `prompt-for-integer`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `prompt-for-integer` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.

The prompter is created by passing `text-input-pane` to `popup-confirm`. Arguments can be passed to the `make-instance` of the pane and the call to `popup-confirm` using `pane-args` and `popup-args` respectively.

**Example**

```lisp
(capi:prompt-for-integer "Enter an integer:" )
(capi:prompt-for-integer "Enter an integer:" :max 10)
(capi:prompt-for-integer "Enter an integer:" :min 100 :max 200)
(capi:prompt-for-integer "Enter an integer:" :ok-check 'evenp)
```

**See also**

`prompt-for-string`

`popup-confirm`

`text-input-pane`

Chapter 11, “Dialogs: Prompting for Input”

**prompt-for-items-from-list**

*Function*

**Summary**

Prompts with a choice of items.

**Package**

capi

**Signature**

`prompt-for-items-from-list items message &key pane-args popup-args interaction choice-class continuation => result, successp`

**Arguments**

- `items` A sequence.
- `message` A string.
- `pane-args` Arguments to pass to the pane.
popup-args Arguments to pass to the confirmer.


choice-class A class name.

continuation A function or nil.

Description The function prompt-for-items-from-list is similar to prompt-with-list. interaction defaults to :extended-selection.

See also prompt-with-list

**prompt-for-number**

**Function**

Summary Prompts the user for a number.

Package capi

Signature prompt-for-number message &key min max initial-value ok-check pane-args popup-args continuation => result, successp

Arguments message A string.
min A number or nil.
max A number or nil.
initial-value A number or nil.
ok-check A function or nil.
pane-args Arguments to pass to the pane.
popup-args Arguments to pass to the confirmer.
continuation A function or nil.
The function `prompt-for-number` pops up a text-input-pane and prompts the user for a number, which is returned in `result`.

The functionality corresponds exactly to that of `prompt-for-integer`, except that all types of numbers are allowed.

See also `prompt-for-integer`

Chapter 11, “Dialogs: Prompting for Input”

**prompt-for-string**

**Function**

**Summary**

Displays a text input pane and prompts the user for a string.

**Package**

capi

**Signature**

`prompt-for-string message &key pane-args popup-args ok-check value-function text initial-value print-function history-symbol history-function continuation => result, okp`

**Description**

The function `prompt-for-string` prompts the user for a string and returns that string in `result` and a flag `okp` indicating that the dialog was not cancelled. The initial string can either be supplied directly as a string using the `text` argument, or by passing `initial-value` and a `print-function` for that value. `print-function` defaults to `princ-to-string`. The value returned can be converted into a different value by passing a `value-function`, which by default is the identity function. This `value-function` gets passed the text that was entered into the pane, and should return both the value to return and a flag that should be non-nil if the value that was entered is not acceptable. If an `ok-check` is passed, then it should return non-nil if the value about to be returned is acceptable.

`prompt-for-string` creates an instance of `text-input-pane` or `text-input-choice` depending on the value of `history-function`. Arguments can be passed to the `make-`
instance of this pane using pane-args. prompt-for-string then passes this pane to popup-confirm. Arguments can be passed to the call to popup-confirm using popup-args.

history-symbol, if non-nil, provides a symbol whose value is used to store an input history, when history-function is not supplied. The default value of history-symbol is nil.

history-function, if supplied, should be a function designator for a function with signature:

```
(history-function &optional push-value)
```

history-function is called with no argument to obtain the history which is used as the items of the text-input-choice, and with the latest input to update the history.

The default value of history-function is nil. In this case, if history-symbol is non-nil then a history function is constructed which stores its history in the value of that symbol.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by prompt-for-string. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-for-string returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

Example

```
(capi:prompt-for-string "Enter a string:")
(capi:prompt-for-string
 "Enter an integer:" :initial-value 10 :value-function #'(lambda (x)
 (let ((integer (ignore-errors (read-from-string x))))
 (values integer (not (integerp integer)))))
```
prompt-for-symbol

Function

Summary
Prompts the user for a symbol.

Package
capi

Signature
prompt-for-symbol message &key initial-value symbols package
ok-check pane-args popup-args continuation => result, okp

Description
The function prompt-for-symbol prompts the user for a symbol which they should enter into the pane.

initial-value, if non-nil, should be a symbol which is initially displayed in the pane.

The symbols that are valid can be constrained in a number of ways.

symbols, if non-nil, should be a list of all valid symbols. The default is nil, meaning all symbols are valid.

package, if non-nil, is a package in which the symbol must be available. The value nil means that the value of *package* is used, and this is the default.

ok-check is a function which when called on a symbol will return non-nil if the symbol is valid.

The prompter is created by calling prompt-for-string. Arguments can be passed to the make-instance of the pane and the call to popup-confirm using pane-args and popup-args respectively, and an input history can be implemented by supplying a history-function or history-symbol in popup-args.

See also
popup-confirm
text-input-pane
Chapter 11, “Dialogs: Prompting for Input”
If `continuation` is non-nil, then it must be a function with a lambda list that accepts two arguments. The `continuation` function is called with the values that would normally be returned by `prompt-for-symbol`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `prompt-for-symbol` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.

Example

```lisp
(capi:prompt-for-symbol "Enter a symbol:"
  :ok-check #'(lambda (symbol)
                (string< symbol "B")))
```

This last example shows how to implement a symbol prompter with an input history:

```lisp
(defvar *my-history* (list "cdr" "car"))
(capi:prompt-for-symbol "Enter a symbol"
  :popup-args
  '(:history-symbol *my-history*))
```

See also

- `prompt-for-form`
- `prompt-for-string`
- `popup-confirm`
- `text-input-pane`

Chapter 11, “Dialogs: Prompting for Input”

**prompt-for-value**

*Function*

**Summary**

Prompts the user for a form to evaluate.
The function `prompt-for-value` prompts the user for a form and returns the result of evaluating that form.

The form is read in the `package` if specified or `*package*` if not and the result is the evaluation of the form.

If `initial-value` is supplied it provides a default form.

If `value-function` is supplied it overrides the default value function which reads the form and evaluates it.

If `continuation` is non-nil, then it must be a function with a lambda list that accepts two arguments. The `continuation` function is called with the values that would normally be returned by `prompt-for-value`. On Cocoa, passing `continuation` causes the dialog to be made as a window-modal sheet and `prompt-for-value` returns immediately, leaving the dialog on the screen. The `with-dialog-results` macro provides a convenient way to create a `continuation` function.

The prompter is created by passing a `text-input-pane` to `popup-confirm`. Arguments can be passed to the `make-instance` of the pane and the call to `popup-confirm` using `pane-args` and `popup-args` respectively.

Example

```lisp
(capi:prompt-for-value
 "Square"
 :initial-value '(+ 1 2 3)
 :value-function
 #'(lambda (text)
    (let ((res (eval (read-from-string text))))
      (* res res)))
```

See also `prompt-for-form`
Function

prompt-with-list

Summary
Prompts the user to select an item or items from a choice.

Package
capi

Signature
prompt-with-list items message &key choice-class interaction
value-function pane-args popup-args continuation buttons callbacks
all-button none-button => result, successp

Arguments
items A sequence.
message A string.
choice-class A class name.
interaction One of :single-selection,
:multiple-selection, or
:extended-selection.
value-function A function, or nil.
pane-args Arguments to pass to the pane.
popup-args Arguments to pass to the confirmer.
continuation A function or nil.
buttons A list of strings or the keyword :none.
callbacks A list of callback specs.
all-button A string, nil or t.
one-button A string, nil or t.

Description
The function prompt-with-list prompts the user with a choice. The user’s selection is normally returned by the prompter.

items supplies the items of the choice.
message supplies a title for the choice.
choice-class determines the type of choice used in the dialog. choice-class defaults to list-panel, and must be a subclass of choice.

interaction determines the interaction style of the choice in the dialog. By default interaction is :single-selection. For single selection, the dialog has an OK and a Cancel button, while for other selection styles it has Yes, No and Cancel buttons where Yes means accept the selection, No means accept a null selection and Cancel behaves as normal. Note that interaction :multiple-selection is not supported for lists on Mac OS X.

The primary returned value is usually the selected items, but a value-function can be supplied that gets passed the result and can then return a new result. If value-function is nil (this is the default), then result is simply the selection.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by prompt-with-list. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-with-list returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

In addition to the choice showing the items, prompt-with-list can also display a panel of push buttons (the "action buttons") which perform actions related to the choice. Note that these buttons are separated from the "dialog buttons" such as OK and Cancel. The dialog buttons are controlled separately by keywords in popup-args.

By default, prompt-with-list does not display action buttons. However, if interaction is :multiple-selection, the default behavior is to display two action buttons, All and None. These change the selection to all of the items or none of the items respectively.
When \textit{buttons} is \texttt{:none}, it specifies no action buttons in any case (including no \texttt{All} and \texttt{None} buttons). Otherwise \textit{buttons} must be a list of strings specifying additional action buttons. Each of the strings specifies a button, and the string is displayed in the button.

\textit{callbacks} specifies the callbacks of the buttons. It should be a list of callback specifiers matching the list in \textit{buttons}. Each callback specifier is either a callable (a function or a symbol) which takes one argument, the choice, or a list where the \texttt{car} is a callable which is called as follows:

\begin{verbatim}
(apply (car callback-spec) choice (cdr callback-spec))
\end{verbatim}

When \texttt{all-button} and \texttt{none-button} are supplied they override the default behavior of the \texttt{All} and \texttt{None} buttons. If \texttt{all-button} (\texttt{none-button}) is \texttt{nil}, then \texttt{All (None)} is not displayed. If \texttt{all-button (none-button)} is non-nil and \texttt{buttons} is not \texttt{:none}, the \texttt{All (None)} button is displayed, and if the value is string, that string is used instead of the default string.

The prompter is created by passing an appropriate pane (in this case an instance of class \texttt{choice-class}) to \texttt{popup-confirm}. Arguments can be passed to the \texttt{make-instance} of the pane and the call to \texttt{popup-confirm} using \texttt{pane-args} and \texttt{popup-args} respectively. The initial selection can be specified using \texttt{choice initargs} :\texttt{selection}, :\texttt{selected-item} or :\texttt{selected-items} in \texttt{pane-args}.

\textbf{Example}

\begin{verbatim}
(capi:prompt-with-list
 '(1 2 3 4 5) "Select an item:")

(capi:prompt-with-list
 '(1 2 3 4 5) "Select some items:
 :interaction :multiple-selection
 :selection '(0 2 4))

(capi:prompt-with-list
 '(1 2 3 4 5) "Select an item:
 :interaction :multiple-selection
 :choice-class 'capi:button-panel)
\end{verbatim}
(capi:prompt-with-list
  '(1 2 3 4 5) "Select an item:
  :interaction :multiple-selection
  :choice-class 'capi:button-panel
  :pane-args
  '(:layout-class capi:column-layout))

There is a more complex example in

(example-edit-file "capi/choice/prompt-with-buttons")

See also
  popup-confirm
  list-panel
  choice
  Chapter 11, “Dialogs: Prompting for Input”

prompt-with-list-non-focus

Function

Summary
Raises a non-focus window.

Signature
prompt-with-list-non-focus items &key owner x y bottom
right choice-class vertical-scroll print-function selection selected-item
visible-items selection-callaction action-callaction destroy-callaction list-
updater gesture-callactions add-gesture-callactions alternative-y
alternative-x alternative-bottom alternative-right widget-name
filtering-gesture filtering-toggle &allow-other-keys => interface

Arguments
  owner A displayed CAPI pane.
  x, alternative-x, right
An integer, or one of the keywords :left,
  :right, :center and :centre.
  alternative-right An integer, or one of the keywords :left,
  :right, :center and :centre, or t.
  y, alternative-y, bottom
An integer, or one of the keywords :top,
  :bottom, :center and :centre.
alternative-bottom An integer, or one of the keywords: top, bottom, center and centre, or t.

choice-class A subclass of list-panel.

selection An integer.

selected-item An item.

visible-items A positive integer.

vertical-scroll A boolean.

print-function A function designator or nil.

selection-callback A function designator or nil.

action-callback A function designator or nil.

destroy-callback A function designator or nil.

list-updater A function designator or nil.

gesture-callbacks A list of pairs of the form (gesture . callback).

add-gesture-callbacks

A list of pairs of the form (gesture . callback).

filtering-gesture A Gesture Spec.

filtering-toggle A Gesture Spec.

widget-name A string.

Values interface A non-focus-list-interface, or nil.

Description The function prompt-with-list-non-focus raises a non-focus window, displaying the items items in a list of class choice-class, which should be list-panel or a subclass.

The non-focus window does not take the input focus, and hence does not see any keyboard input unless this is passed to it by non-focus-maybe-capture-gesture. It responds to mouse gestures.
Note that even moving the selection in the list vertically in response to the arrow keys cannot happen without non-focus-maybe-capture-gesture.

owner is required, and must be a CAPI pane visible on the screen. The position of the non-focus window is determined relative to owner, and the callbacks are invoked in the process of owner.

\( x, y, \text{right}, \text{bottom}, \text{alternative-x}, \text{alternative-y}, \text{alternative-right}, \) and \( \text{alternative-bottom} \) are used for positioning the window. \( x, \text{alternative-right}, \text{alternative-x} \) and \( \text{right} \) are the horizontal keywords, and one of them determines the horizontal position as described below. \( y, \text{alternative-bottom}, \text{alternative-y} \) and \( \text{bottom} \) are the vertical keywords, and one of them determines the vertical position. The values \( \text{center} \) and \( \text{centre} \) are synonyms here.

\( x \) and \( y \) specify the positioning of the left and top sides of the window, except for \( \text{center}/\text{centre} \). An integer means offset in pixels from the left or top of owner. \( \text{left}, \text{right}, \text{top} \) and \( \text{bottom} \) mean the left/right/top/bottom of owner. \( \text{center} \) means the center of the owner, and in this case it specifies the location of the center of the window in the \( x \) or \( y \) dimension. \( x \) must be supplied, unless \( \text{right} \) is supplied. \( y \) must be supplied, unless \( \text{bottom} \) is supplied.

\( \text{right} \) and \( \text{bottom} \) override \( x \) and \( y \) respectively. They specify the positioning of the right or bottom of the window, except for \( \text{center}/\text{centre} \), where they are interpreted in the same way as \( x \) and \( y \).

\( \text{alternative-x}, \text{alternative-y}, \text{alternative-right}, \) and \( \text{alternative-bottom} \) are used if positioning the window using \( x \) or \( \text{right} \) and \( y \) or \( \text{bottom} \) would place it outside of the screen, and are interpreted the same way as the non-alternative keywords. For example, both Editor completion and text-input-pane completion specify a \( y \) coordinate below the text, and \( \text{alternative-bottom} \) above the text. The decision to use the alternative variables is made independently in the horizontal and verti-
cal directions. alternative-right and alternative-bottom can both take the special value t, meaning the height or width of the screen.

The default value of choice-class is list-panel.

selection or selected-item can be used to specify the initially selected item in the list. If neither of these initargs is supplied, the first item is selected.

visible-items specifies the height of the list panel when the filter is not visible. The default value of visible-items is 20.

vertical-scroll is supplied to cl:make-instance when making the list. The default value of vertical-scroll is t.

print-function is also supplied to cl:make-instance when making the list. The default value of print-function is nil.

selection-callback, if non-nil, should be a function of two arguments, the selected item and the non-focus interface. selection-callback is called (in the process of owner) when an item is selected in the list panel. Note that callback-type does not affect the arguments passed to selection-callback.

action-callback, if non-nil, should also be a function of two arguments, the selected item and the non-focus interface. action-callback is called (in the process of owner) when an item is double-clicked in the list panel, or when Return is passed to non-focus-maybe-capture-gesture (by default, see gesture-callbacks). Note that callback-type does not affect the arguments passed to action-callback.

destroy-callback, if non-nil, should be a function of one argument, the non-focus window (a CAPI interface). destroy-callback is called when the non-focus window is destroyed. It is invoked in the process of owner.

list-updater, if non-nil, should be a function with signature

list-updater => result
list-updater is called in the process of owner whenever non-focus-update is called. result must be a list of items to put into the list panel, or one of the special values t (meaning no effect) and :destroy (meaning destroy the non-focus window).

gesture-callbacks and add-gesture-callbacks define gesture callbacks which the non-focus window can “capture” (when non-focus-maybe-capture-gesture is called). gesture-callbacks and add-gesture-callbacks should both be a list of pairs of the form (gesture . callback). Each gesture must be a gesture specifier, that is an object that sys:coerce-to-gesture-spec can coerce to a Gesture Spec. Each callback is either a callable (symbol or function) which takes one argument, the non-focus window, or a list of the form (function arguments). Note that when it is a list, the window is not automatically passed to the function function amongst the arguments arguments. The gesture callbacks are used only when non-focus-maybe-capture-gesture is called.

add-gesture-callbacks adds more gesture callbacks to those that are implicitly defined for controlling the list panel (see non-focus-maybe-capture-gesture). gesture-callbacks, if supplied, replaces the gesture callbacks that are implicitly defined for the list panel. In both cases, a gesture callback that is defined explicitly overrides any implicitly define gesture callback.

filtering-gesture defines whether it is possible for the user to add a filter to the non-focus window with a keyboard gesture, and defines that gesture. The gesture is actually a toggle: it destroys a filter that is on, and adds a filter when none is present. When the filter is added, its text is reset and it is always enabled, that is it captures characters and Backspace. While the filter is visible, the list panel displays only items that match the filter (see “Filters” on page 53). The default value of filtering-gesture is a Gesture Spec matching Control+Return.
filtering-toggle defines whether it is possible for the user to disable/enable the filter with a keyboard gesture, and defines that gesture. When a filter is visible and enabled, the non-focus window captures characters and Backspace (when non-focus-maybe-capture-gesture is called) and passes them to the filter. When the filter is visible and disabled, characters and Backspace are captured. The default value of filtering-toggle is a Gesture Spec matching Control+Shift+Return.

widget-name has an effect only on GTK+ and Motif. It defines the widget name of the interface, which can then be used to define resources specific to the non-focus window. Note that the non-focus completers in editor-pane and text-input-pane use the default widget-name which is "non-focus-list-prompter", so defining resources for non-focus-list-prompter will affect them.

If items is nil, prompt-with-list-non-focus returns nil without doing anything. Otherwise, it raises the non-focus window and returns the interface, which is of class non-focus-list-interface.

The non-focus window is "passive", because it does not see keyboard input. It is the responsibility of the caller to pass any keyboard input that the non-focus window needs to process to the window, by using non-focus-maybe-capture-gesture. In general, that should be all keyboard gestures, and non-focus-maybe-capture-gesture decides which gestures it wants to process.

The caller can also use non-focus-terminate, non-focus-update, non-focus-list-toggle-filter, non-focus-list-add-filter, non-focus-list-remove-filter and non-focus-list-toggle-enable-filter to control the non-focus window.
See also

- list-panel
- non-focus-terminate
- non-focus-update
- non-focus-list-toggle-filter
- non-focus-list-toggle-enable-filter
- non-focus-maybe-capture-gesture
- “In-place completion” on page 168

prompt-with-message

Function

Summary
Displays a message dialog, allowing it to be a window-modal sheet on Cocoa.

Package
capi

Signature
prompt-with-message message &key owner continuation

Arguments
message A string.
owner An owner window, or nil.
continuation A function or nil.

Description
The function prompt-with-message displays message in a dialog owned by owner.

If continuation is non-nil, then it must be a function with a lambda list that accepts two arguments. The continuation function is called with the values that would normally be returned by prompt-with-message. On Cocoa, passing continuation causes the dialog to be made as a window-modal sheet and prompt-with-message returns immediately, leaving the dialog on the screen. The with-dialog-results macro provides a convenient way to create a continuation function.

Example

(capi:prompt-with-message
  "No items were deleted.")
See also  
- display-message-for-pane
- display-message

### push-button

#### Class

**Summary**  
A push-button is a pane that displays either a piece of text or an image and when it is pressed it performs an action.

**Package**  
capi

**Superclasses**  
button

titled-object

**Initargs**  
:alternate-callback

A callback invoked on Microsoft Windows, Cocoa and GTK+ when pressing the mouse button over the push-button while a platform-specific modifier key is held down.

:press-callback

A callback invoked on Microsoft Windows, GTK+ and Motif when pressing the mouse button over the push-button.

**Accessors**  
button-alternate-callback

button-press-callback

**Description**  
The class push-button inherits most of its behavior from button. Note that it is normally best to use a push-button-panel rather than make the individual buttons yourself, as the button panel provides functionality for handling groups of buttons. However, push buttons can be used if you need to have more control over the button’s behavior.
press-callback, if non-nil, should be a function which is called when the user presses the mouse left button over the push button. The arguments to press-callback are as specified by callback-type. This initarg is not supported on Cocoa.

alternate-callback, if non-nil, should be a function. On Microsoft Windows and GTK+, it is called instead of callback when the button is clicked with the Control key held down. On Cocoa, it is called instead of callback when the button is clicked with the Command key held down. alternate-callback is not implemented for Motif or for other classes of button.

Notes

callback (from superclass button) is the general callback, triggered when the user clicks the button, either by pressing and releasing the mouse button or by a keyboard gesture.

press-callback is called only when the user presses the mouse button.

Example

```lisp
(setq button (capi:contain
  (make-instance
   'capi:push-button
   :text "Press Me"
   :data '(:some :data)
   :callback #'(lambda (data interface)
                (capi:display-message
                 "Pressed ~S" data)))))

(capi:apply-in-pane-process
 button #'(setf capi:button-enabled) nil button)

(capi:apply-in-pane-process
 button #'(setf capi:button-enabled) t button)
```

See also

radio-button
check-button
button-panel
push-button-panel
"CAPI elements" on page 2
“Button elements” on page 31
Chapter 12, “Creating Panes with Your Own Drawing and Input”

push-button-panel

Class

Summary
A push-button-panel is a pane containing a group of buttons.

Package
capi

Superclasses
button-panel

Description
The class push-button-panel inherits all of its behavior from button-panel, which itself inherits most of its behavior from choice. Thus, the push button panel can accept items, callbacks, and so on.

Example
(defun test-callback (data interface)
  (capi:display-message
   "Pressed ~S" data))

(capi:contain (make-instance 'capi:push-button-panel
  :title "Press a button:"
  :items
  '("Press Me" "No, Me")
  :selection-callback
  'test-callback))

(capi:contain (make-instance 'capi:push-button-panel
  :title "Press a button:"
  :items
  '("Press Me" "No, Me")
  :selection-callback
  'test-callback
  :layout-class
  'capi:column-layout))
(capi:contain (make-instance 'capi:push-button-panel
   :title "Press a button:"
   :items '(1 2 3 4 5 6 7 8 9)
   :selection-callback
   'test-callback
   :layout-class
   'capi:grid-layout
   :layout-args
   '(:columns 3)))

There is a further example here:

(example-edit-file "capi/buttons/buttons")

See also
push-button
radio-button-panel
check-button-panel
Chapter 5, “Choices - panes with items”

quit-interface

Function

Summary              Closes the top level interface containing a specified pane.

Package              capi

Signature            quit-interface pane &key force => result

Arguments            pane  A CAPI element.
                      force A boolean. The default value is nil.

Values               result t if the interface was closed, nil otherwise.

Description          The function quit-interface closes the top level interface
                      containing pane, but first it verifies that it is OK to do this by
                      calling the interface’s confirm-destroy-function. If it is OK to
                      close the interface, it then calls destroy to do so. If force is
                      true, then neither the confirm-destroy-function or the
                      destroy-callback are called, and the window is just closed
                      immediately.
Notes  

*quit-interface* must only be called in the process of the top level interface of *pane*. Menu callbacks on that interface will be called in that process, but otherwise you probably need to use *execute-with-interface* or *apply-in-pane-process*.

Example  

Here are two examples demonstrating the use of *quit-interface* with the *destroy-callback* and the *confirm-destroy-function*.

```lisp
(setq interface (capi:display
  (make-instance
    'capi:interface
    :title "Test Interface"
    :destroy-callback
    #'(lambda (interface)
        (capi:display-message
         "Quitting -S" interface))))

(capi:apply-in-pane-process
  interface 'capi:quit-interface interface)

With this second example, the user is prompted as to whether or not to quit the interface.

(setq interface (capi:display
  (make-instance
    'capi:interface
    :title "Test Interface"
    :confirm-destroy-function
    #'(lambda (interface)
        (capi:confirm-yes-or-no "Really quit -S" interface))))

(capi:apply-in-pane-process
  interface 'capi:quit-interface interface)

See also  

*destroy*

*display*

*interface*

Chapter 7, “Programming with CAPI Windows”
radio-button

Class

Summary
A button that can be either selected or deselected, but when selecting it any other buttons in its group will be cleared.

Package  
capi

Superclasses  
button
titled-object

Description
The class radio-button inherits most of its behavior from button. Note that it is normally best to use a radio-button-panel rather than make the individual buttons yourself, as the button-panel provides functionality for handling groups of buttons. However, radio buttons are provided in case you need to have more control over the button’s behavior.

Example

(setq button (capi:contain
(make-instance 'capi:radio-button
:text "Press Me")))

(capi:apply-in-pane-process
button #'(setf capi:button-selected) t button)

(capi:apply-in-pane-process
button #'(setf capi:button-selected) nil button)

(capi:apply-in-pane-process
button #'(setf capi:button-enabled) nil button)

(capi:apply-in-pane-process
button #'(setf capi:button-enabled) t button)

There is a further example here:

(example-edit-file "capi/buttons/buttons")
See also  push-button
          check-button
          button-panel
          radio-button-panel
          “Button elements” on page 31

radio-button-panel  
Class

Summary  A pane containing a group of buttons of which only one can be selected at any time.

Package  capi

Superclasses  button-panel

Description  The class radio-button-panel inherits all of its behavior from button-panel, which itself inherits most of its behavior from choice. Thus, the radio button panel can accept items, callbacks, and so forth.

Example  

```lisp
(capi:contain (make-instance
               'capi:radio-button-panel
               :title "Select a color:"
               :items '(:red :green :blue)
               :print-function 'string-capitalize))

(setq buttons (capi:contain
                (make-instance
                 'capi:radio-button-panel
                 :title "Select a color:"
                 :items '(:red :green :blue)
                 :print-function 'string-capitalize
                 :layout-class 'capi:column-layout)))

(capi:choice-selected-item buttons)

There is a further example here:

(example-edit-file "capi/buttons/buttons")
```
See also  
radio-button  
push-button-panel  
check-button-panel  
Chapter 5, “Choices - panes with items”

**raise-interface**  
*Function*

**Summary**

Raises the interface containing a specified pane to the front of the screen.

**Package**

capi

**Signature**

raise-interface **pane**

**Description**

The function raise-interface raises the window containing **pane** to the front of the screen. To push it to the back use lower-interface, and to iconify it use hide-interface.

**Example**

```lisp
(setq pane (capi:contain
            (make-instance
              'capi:text-input-pane)))

(capi:apply-in-pane-process
 pane 'capi:lower-interface pane)

(capi:apply-in-pane-process
 pane 'capi:raise-interface pane)
```

**See also**

activate-pane  
hide-interface  
interface  
lower-interface  
quit-interface  
“Manipulating top-level windows” on page 105
range-pane

Summary A class supporting progress-bar and slider.

Package capi

Superclasses None

Subclasses progress-bar scroll-bar slider

Initargs :start An integer specifying the lowest value of the range.
:end An integer specifying the highest value of the range.
:slug-start An integer specifying the start of the slug, corresponding to the current value of the range.
:slug-end An integer specifying the end of the slug.
:callback Called when the user changes the value.
:orientation One of :horizontal (the default) or :vertical.

Accessors range-start range-end range-slug-start range-slug-end range-callback range-orientation

Description The class range-pane exists to support the progress-bar and slider classes. Consult the reference pages for progress-bar and slider for further information.
See also

progress-bar
slider
“Slider, Progress bar and Scroll bar” on page 29

range-set-sizes

Function

Summary
Set values in a range-pane.

Signature
range-set-sizes range-pane &key start end slug-start slug-end redisplay

Arguments
range-pane A range-pane.
start A real number or nil.
end A real number or nil.
slug-start A real number or nil.
slug-end A real number or nil.

Description
The function range-set-sizes set the values in the range-pane range-pane for any value of start, end, slug-start or slug-end that is supplied as non-nil.

For each of start, end, slug-start and slug-end, if the value is nil or not supplied, the corresponding value in range-pane is not changed.

If redisplay is true then range-pane is redisplayed with the new values.

The default value of redisplay is t.

Notes
The values can be also set individually by the accessors (setf range-start) and so on. range-set-sizes has the advantage over the accessors that it causes fewer calls to redisplay.
See also  
range-pane
“Slider, Progress bar and Scroll bar” on page 29

read-sound-file
Function

Summary  
Reads data from a sound file on Microsoft Windows and Cocoa.

Package  
capi

Signature  
read-sound-file source => array

Arguments  
source  
A pathname designator.

Values  
array  
An array of element type (unsigned-byte 8).

Description  
The function read-sound-file reads data from source and returns an array of its contents.

Notes  
1. read-sound-file can be called during image building.
2. read-sound-file is not implemented on GTK+ and Motif.

See also  
load-sound
“Sounds” on page 264

record-dependent-object
unrecord-dependent-object  
Functions

Summary  
Register or unregister an object for destruction when a pin-board-layout is destroyed.

Package  
capi
Signature

```
record-dependent-object  pinboard-layout  object
unrecord-dependent-object  pinboard-layout  object
```

Arguments

- `pinboard-layout`  A pinboard-layout.
- `object`  A Lisp object.

Description

The functions `record-dependent-object` and `unrecord-dependent-object` are part of a mechanism for destroying objects when a `pinboard-layout` is destroyed.

- `record-dependent-object` records the object `object`, which means that when `pinboard-layout` is destroyed, `destroy-dependent-object` is applied to `object`.
- `unrecord-dependent-object` removes `object` from the dependents, comparing objects by `cl:equal`.

It is possible to record the same object more than once. `unrecord-dependent-object` removes one occurrence of `object` at most. If there is no object, it does nothing.

Notes

These functions are not designed to deal with many calls to `record-dependent-object` and `unrecord-dependent-object`. If you need to deal with many objects, you can either use the `destroy-callback` of `pinboard-layout` (inherited from `output-pane`), or add a single object of your object type (class or structure) and define a `destroy-dependent-object` method for it that will deal with the many objects in an optimal way.

See also

- `destroy-dependent-object`
- `pinboard-layout`

**rectangle**

Summary

A `pinboard-object` that draws a rectangle.
Package    capi
Superclasses   pinboard-object
Subclasses   None.
Initargs    :filled  A boolean, default value nil.
Accessors   filled
Description   The class rectangle provides a simple pinboard-object that draws a rectangle.

The rectangle is always drawn with shape-mode :plain (that is, without anti-aliasing).

filled determines whether the rectangle is filled.

See also   “Creating graphical objects” on page 187

redisplay-collection-item  Generic Function

Summary   Redisplays the area in a collection that belongs to an item.

Package    capi
Signature   redisplay-collection-item collection item
Description   The generic function redisplay-collection-item redisplays item in collection.

There are methods supplied for graph-pane and tree-view.

See also   collection
**redisplay-interface**

*Generic Function*

**Summary** Updates the state of an interface.

**Package** capi

**Signature** redisplay-interface interface

**Description** The generic function `redisplay-interface` updates the state of an interface, such as enabling and disabling menus, buttons, and so forth, that might have changed since the last call. When using this as a callback, you can use `:redisplay-interface` instead of the symbol, and then it will get passed the correct arguments regardless of the callback type.

**Notes** This method is called by `popup-confirm` to update its button’s enabled state, and so it should be called when state changes in a dialog.

**See also**

<table>
<thead>
<tr>
<th>interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>redraw-menu-bar</td>
</tr>
<tr>
<td>redraw-pinboard-layout</td>
</tr>
<tr>
<td>display</td>
</tr>
</tbody>
</table>

Chapter 11, “Dialogs: Prompting for Input”

---

**redisplay-menu-bar**

*Function*

**Summary** Updates the menu bar of an interface.

**Package** capi

**Signature** redisplay-menu-bar interface &key redo-items

**Arguments**

| interface | An interface. |
| redo-items | A generalized boolean. |
Description

The function `redisplay-menu-bar` updates the interface’s menu bar, such that menus become enabled and disabled as appropriate.

When `redo-items` is non-nil, `redisplay-menu-bar` redoes the items in `menu` and `menu-component` that have an `items-function`, by calling the `items-function` and setting the items. The default value of `redo-items` is `t`.

Notes

`redo-items` defaults to `t` in order to ensure that any accelerator associated with any item is up-to-date. When the menu bar contains menus (including sub-menus and menu-components) that have an `items-function`, `redisplay-menu-bar` may take a relatively long time (tens of milliseconds). If it is called often (for example, each time the user types a character), then it is better to call `redisplay-menu-bar` with `redo-items nil`.

Compatibility note

This function has been superseded by `redisplay-interface`, which updates the menu bar, but also updates other state objects such as buttons, list panels and so on.

See also

`interface`
`redisplay-interface`

redraw-drawing-with-cached-display

Function

Summary

Redraws a pane with cached display, in particular the areas that were drawn by calls to a `temp-display-callback`

Package
capi

Signature
`redraw-drawing-with-cached-display pane`

Arguments
`pane` An output-pane.
Description  The function `redraw-drawing-with-cached-display` redraws the output pane `pane`, in particular the areas that were drawn by calls to the `temp-display-callback`. This has the effect of restoring the display to how it was in the last call to `start-drawing-with-cached-display`.

This function must be called in the scope of `start-drawing-with-cached-display` or `output-pane-free-cached-display`. Calls outside this scope have no effect.

Notes  This redraws only what it thinks needs to be redrawn. To redraw all of the pane, use `update-drawing-with-cached-display` passing only the pane.

See also  `start-drawing-with-cached-display`  `update-drawing-with-cached-display`

---

redraw-pinboard-layout  

Function

Summary  Redraws any pinboard objects within a specified rectangle.

Package  capi

Signature  `redraw-pinboard-layout pinboard x y width height &optional redisplay`

Description  The function `redraw-pinboard-layout` causes any pinboard objects within the given rectangle of the pinboard layout to get redrawn.

If `redisplay` is `nil`, then the redisplay will be cached until a later update. The default for `redisplay` is `t`.

See also  `pinboard-object`  `redraw-pinboard-object`
redraw-pinboard-object

Function

Summary
Redraws a specified pinboard object.

Package
capi

Signature
redraw-pinboard-object object &optional redisplay

Description
The function redraw-pinboard-object causes the pinboard object object to be redrawn, unless redisplay is nil in which case the redisplay will be cached until a later update. The default for redisplay is t.

Example
There are examples here:

(example-edit-file "capi/graphics/")

See also
pinboard-object
pinboard-layout
redraw-pinboard-layout

reinitialize-interface

Generic Function

Summary
Reinitializes an existing interface.

Package
capi

Signature
reinitialize-interface interface &rest initargs

Description
The generic function reinitialize-interface reinitializes an existing instance of a subclass of interface.

reinitialize-interface is called automatically by find-interface when this re-uses an interface.

You can add methods to specialize on subclasses of interface which you define.
Function

remove-capi-object-property

Summary
Removes a property from the property list of an object.

Package
capi

Signature
remove-capi-object-property object property

Description
The function remove-capi-object-property removes a property from the property list of an object.

All CAPI objects contain a property list, similar to the symbol plist. The functions capi-object-property and (setf capi-object-property) are the recommended ways of setting properties, and remove-capi-object-property is the way to remove a property.

Example

(setq pane (make-instance 'capi:list-panel
 :items '(1 2 3)))

(capi:capi-object-property pane 'test-property)

(setf (capi:capi-object-property pane 'test-property)
 "Test")

(capi:capi-object-property pane 'test-property)

(capi:remove-capi-object-property pane 'test-property)

(capi:remove-capi-object-property pane 'test-property)

See also
capi-object-property
capi-object

“Object properties and name” on page 265
**remove-items**

*Generic Function*

**Summary**
Removes some items from a collection.

**Package**
capi

**Signature**
remove-items collection list-or-predicate

**Arguments**
collection A collection.
list-or-predicate A list, or a function of one argument returning a boolean value.

**Description**
The generic function `remove-items` removes from the collection `collection` those items determined by `list-or-predicate`.

If `list-or-predicate` is list, then the items removed are those matching some element of `list-or-predicate`, compared by the test-function of `collection`. Otherwise, the items removed are those for which the function `list-or-predicate` returns true.

This is logically equivalent to recalculating the collection items and then calling `(setf collection-items)`. However, `remove-items` is more efficient and causes less flickering on screen.

`remove-items` can only be used when the `collection` has the default `items-get-function svref`.

**Notes**
`remove-items` cannot be used a **graph-pane** or a **tree-view**.

**See also**
append-items
collection
replace-items
Chapter 5, “Choices - panes with items”
replace-dialog

**Function**

**Summary**
Replaces a replacable dialog.

**Package**
capi

**Signature**
replace-dialog interface &rest args => nil

**Arguments**
- interface: An interface.
- args: Other arguments as for display-dialog.

**Description**
The function replace-dialog displays a dialog in the same way the display-dialog does, except that it also destroys the existing dialog.

interface is a CAPI interface to be displayed as a dialog.

The arguments args are interpreted the same as the arguments to display-dialog, except that modal is ignored.

replace-dialog displays the dialog like display-dialog.

**See also**
display-replacable-dialog

replace-items

**Generic Function**

**Summary**
Replaces some items in a collection.

**Package**
capi

**Signature**
replace-items collection items &key start new-selection

**Arguments**
- collection: A collection.
- items: A list.
- start: A non-negative integer.
- new-selection: A list specifying the selection.
Description

The generic function `replace-items` replaces some items in the `collection` `collection` from `items`. `replace-items` can only be used when the `collection` has the default `items-get-function` `svref`.

`start` should be a non-negative integer and less than the number of items in `collection`.

Items in `collection` are replaced starting at index `start`, and proceeding until the end of the list `items`, or the end of the items in `collection`. If `items` is too long, the surplus is quietly ignored. `replace-items` never alters the number of items in the collection.

If supplied, `new-selection` should be a list of items specifying the new selection in `collection`. To specify no selection, pass `nil`.

If `new-selection` is not supplied, then `replace-items` attempts to preserve the selection. If some of the selected items are replaced, then the selection on these items is removed, but if a selected item simply moves, then the selection moves with it.

Notes

`replace-items` cannot be used a `graph-pane` or a `tree-view`.

See also

`append-items`
`collection`
`remove-items`

Chapter 5, “Choices - panes with items”

---

`report-active-component-failure`  

Generic Function

Summary

Reports on failures to find or create a component.

Package  
capi
### Signature

```lisp
(report-active-component-failure pane component-name error-string function-name hresult)
```

### Arguments

- **pane**: An `ole-control-pane`.
- **component-name**: A string or `nil`.
- **error-string**: A string.
- **hresult**: An integer or `nil`.

### Description

The generic function `report-active-component-failure` is used to report on failures to find or create a component.

- **component-name**: The name of the component it tried to find.
- **error-string**: The error string.
- **function-name**: The name of the function that actually failed.
- **hresult**: The hresult that came back. It may be `nil` if the error is that the guid of the named component could not be found.

When the system fails to open the component, it calls `report-active-component-failure`, with the first argument the `ole-control-pane` `pane`. The default method for `ole-control-pane` tries to call `report-active-component-failure` again on its top level interface. The default method on `interface` calls `error`.

You can add your own methods, specializing on subclasses of `ole-control-pane` or subclasses of `interface`.

### Notes

This function is implemented only in LispWorks for Windows. Load the functionality by `(require "embed")`.

### See also

- `ole-control-pane`

---

### Function

#### `reuse-interfaces-p`

**Summary**

Determines whether global interface re-use is enabled.
**api**

**Signature**

text-to-integer-ep => result

**Signature**

(setf text-to-integer-ep) value => value

**Arguments**

value A boolean.

**Values**

result A boolean.

**Description**

The function **text-to-integer-ep** is the predicate for whether global interface re-use is enabled.

The function **(setf text-to-integer-ep)** enables or disables global interface re-use.

If global re-use is enabled, then **locate-interface** and **find-interface** may return existing interfaces. If global re-use is disabled, then **locate-interface** returns nil and **find-interface** returns a new interface.

**See also**

find-interface
locate-interface

---

**rich-text-pane**

**Class**

**Summary**

A text pane with extended formatting.

**Package**

capi

**Superclasses**

simple-pane

**Initargs**

:character-format

A plist.

:paragraph-format

A plist.
:change-callback
   A function called when a change is made.

:protected-callback
   A function determining whether the user may edit a protected part of the text, on Microsoft Windows.

:filename
   A file to display.

:text
   A string or nil.

:text-limit
   An integer.

Accessors
rich-text-pane-change-callback
rich-text-pane-limit
rich-text-pane-text

Description
The class rich-text-pane provides a text editor which supports character and paragraph formatting of its text.

character-format is the default character format. It is a plist which is interpreted in the same way as the attributes-plist argument of set-rich-text-pane-character-format. The default value of character-format is nil.

paragraph-format is the default paragraph format. It is a plist which is interpreted in the same way as the attributes-plist argument of set-rich-text-pane-paragraph-format. The default value of paragraph-format is nil.

change-callback, if non-nil, is a function of two arguments: the pane itself, and a keyword denoting the type of change. This second argument is either :text or :selection. The default value of change-callback is nil.

protected-callback, if supplied, is called when the user tries to modify protected text. (Text is protected by setting the protected attribute, see set-rich-text-pane-character-format.) protected-callback must be a function of four arguments: the pane itself, bounding indexes of the protected text, and a boolean which is true when the change would affect the
selection. If the change would affect just a single character, this last argument is nil. If protected-callback returns nil, then the change is not performed. If protected-callback is not supplied, then the user cannot modify protected text. protected-callback is supported only on Microsoft Windows.

filename, if non-nil, should be a string or pathname naming a file to display in the pane. filename takes precedence over text if both are non-nil.

text, if non-nil, should be a string which is displayed in the pane if filename is nil.

text-limit, if non-nil, should be an integer which is an upper bound for the length of text displayed in the pane.

Notes

1. rich-text-pane is supported only on Microsoft Windows, and Cocoa in Mac OS X 10.3 and later. Some of its features are supported only on Microsoft Windows, as mentioned above.

2. change-callback and protected-callback are not yet implemented on Cocoa.

3. The functions that are specific to rich-text-pane cannot be called before the pane is created. If you need to perform operations on the pane before it appears, and which cannot be performed using the initargs, the best approach is to define an :after method on interface-display on the class of the interface containing the rich-text-pane, and perform the operations inside this method.

See also

print-rich-text-pane
rich-text-pane-character-format
rich-text-pane-operation
set-rich-text-pane-character-format
rich-text-pane-paragraph-format
set-rich-text-pane-paragraph-format
“Displaying rich text” on page 27
Function

**Summary**

Returns the character format.

**Package**

capi

**Signature**

rich-text-pane-character-format pane &key selection => result

**Arguments**

- pane: A rich-text-pane.
- selection: Must be t. This argument is deprecated.

**Values**

result: A plist.

**Description**

The function `rich-text-pane-character-format` returns as a plist the current character attributes for `pane`.

If there is a current selection in the pane, then the attributes are those set for the selected text. If there is no selection, then it gets the "typing attributes", which are applied to characters that are typed by the user. Note that any cursor movement changes these attributes, so their values are ephemeral.

The `selection` argument is deprecated. If `selection` is `nil` an error is signalled. The default value of `selection` is `t`.

An attribute appears in `result` only if its value is the same over all of the range. Therefore this form

```
(getf
  (capi:rich-text-pane-character-format pane) :bold
  :unknown)
```

will return:

- `t` if all the selection is bold.
- `nil` if all the selection is not bold.
- `:unknown` if the selection is only partially bold.

For the possible attributes, see `set-rich-text-pane-character-format`. 

---

821
Compatibility note
The value `nil` for the keyword argument `:selection` is not supported in LispWorks 6.1 and later. See the description above for details of the current behavior with respect to the current selection in the `rich-text-pane`.

See also
`rich-text-pane`
`set-rich-text-pane-character-format`

### `rich-text-pane-operation` Function

**Summary**
Gets and sets values and performs various operations on the pane.

**Package**
capi

**Signature**

```
rich-text-pane-operation pane operation &rest args => result, result2
```

**Arguments**
- `pane` A `rich-text-pane`.
- `operation` A keyword specifying the operation to perform.
- `args` The value or values to use, when the operation is setting something.

**Values**
- `result` Various, see below.
- `result2` Returned only for operation `:get-selection`, see below.

**Description**
The valid values of `operation` on Microsoft Windows and Cocoa are:

- `:pастеp, :cutp or :copyp`

  `result` is a boolean indicating whether it is currently possible to perform a `:paste`, `:cut` or `copy` operation.
:paste, :cut, or :copy

Performs the indicated operation.

:select-all

Selects all the text.

:set-selection

args should be two integers start and end.

Sets the selection to the region bounded by start (inclusive) and end (exclusive).

:get-selection

Returns as multiple values the bounding indexes of the selection. result is the start (inclusive) and result2 is the end (exclusive).

If there is no selection, both values are the index of the insertion point.

:can-undo or :can-redo

result is a boolean indicating whether it is currently possible to perform an :undo or :redo operation.

:undo

Undoes the last editing operation. Note that, after typing, it is the whole input, rather than a single character, that is undone. The :undo operation may be repeated successively, to undo previous editing operations in turn.

Note: with RichEdit 1.0, :undo does not work repeatedly - it only undoes one previous editing operation. See rich-text-version.

:redo

Undoes the effect of the last :undo operation. The :redo operation may be repeated successively, to cancel the effect of previous :undo operations in turn.

Note: with RichEdit 1.0, :redo does not work. See rich-text-version.
:get-modified result is the value of a boolean modified flag. This flag can be set by the :set-modified operation. Also, editing the text sets it to true.

:set-modified Sets the modified flag. The argument is a boolean.

:save-file Saves the text to a file. Details below.

:load-file Loads the text from a file. Details below.

Additionally these values of operation are valid on Microsoft Windows, only:

:get-word-wrap
Returns a value indicating the word wrap, which can be the keyword :none. result can also be the keyword :window or a CAPI printer object, meaning that the text wraps according to the width of the window or the printer.

:set-word-wrap
Sets the word wrap. The argument can be as described for :get-word-wrap, and additionally it can be the keyword :printer, meaning the current-printer.

:hide-selection
Specifies whether the selection should be hidden (not highlighted) when pane does not have the focus. The argument is a boolean.

For operations :save-file and :load-file, args is a lambda list

filename &key selection format plain-text

filename is the file to save or load.

selection is a boolean, with default value nil.
format is nil or a keyword naming the file format. Values include :rtf and :text meaning Rich Text Format and text file respectively.

plain-text is a boolean, with default value nil.

With operation :save-file, if selection is true, only the current selection is saved. If selection is nil, all the text is saved. The default value of format is :rtf and there are two further allowed values, :rtfnoobjs and :textized. These are like :rtf and :text except in the way they deal with COM objects. See the documentation for SF_RTFNOOBS and SF_TEXTIZED in the EM_STREAMOUT entry in the MSDN for details. When saving with format :rtf or :rtfnoobjs, if plain-text is true, then keywords that are not common to all languages are ignored. With other values of format, plain-text has no effect.

With operation :load-file, if selection is true, the unselected text is preserved. If there is a selection, the new text replaces it. If there is no selection, the new text is inserted at the current insertion point. If selection is nil, all the text is replaced. The default value of format is nil, meaning that the RTF signature is relied upon to indicate a Rich Text Format file. If plain-text is true, then keywords that are not common to all languages are ignored.

Example

(setq rtp
  (capi:contain
    (make-instance 'capi:rich-text-pane
      :text (format nil "First paragraph.~%Second paragraph, a little longer.~%Another paragraph, which should be long long enough that it spans more than one line. ~\%" )))))

Set the selection to characters 9 to 18:

  (capi:rich-text-pane-operation rtp :set-selection 9 18)

Write all the text to a file in text format:
(capi:rich-text-pane-operation
  rtp :save-file "mydoc.txt" :format :text)

Paste:

(capi:rich-text-pane-operation rtp :paste)

See also

rich-text-pane
rich-text-version

**rich-text-pane-paragraph-format**

*Function*

Summary

Returns the paragraph format.

Package

capi

Signature

rich-text-pane-paragraph-format pane => result

Arguments

pane A rich-text-pane.

Values

result A plist.

Description

The function rich-text-pane-paragraph-format returns as a plist the paragraph attributes of the current paragraphs in pane.

For the possible attributes, see set-rich-text-pane-paragraph-format.

See also

rich-text-pane

**rich-text-version**

*Function*

Summary

Identifies the version of RichEdit in use, on Microsoft Windows.

Package

capi
Signature \textbf{rich-text-version => result}

Values \textit{result} A keyword indicating the version of the RichEdit control in use.

Description \textit{result} is \texttt{:rich-edit-2.0} if RichEdit 2.0 or newer is loaded. Otherwise \textit{result} is \texttt{:rich-edit-1.0}.

\texttt{rich-text-version} is supported only on Microsoft Windows.

See also \texttt{rich-text-pane}

\textbf{right-angle-line-pinboard-object} \textit{Class}

Summary A subclass of \texttt{pinboard-object} that displays a line drawn around two edges of the area enclosed by the pinboard object.

Package \texttt{capi}

Superclasses \texttt{line-pinboard-object}

Initargs \texttt{:type} The type of line.

Description A subclass of \texttt{line-pinboard-object} which displays a line around the edge of the pinboard object rather than diagonally.

\texttt{type} can be one of two values.

\texttt{:vertical-first}

\hspace{1cm} Draw top-left to bottom-left to bottom-right.

\texttt{:horizontal-first}

\hspace{1cm} Draw top-left to top-right to bottom-right.
The main use of this class is to produce graphs with right-angled edges rather than diagonal ones.

Example

(capi:contain
 (make-instance
  'capi:right-angle-line-pinboard-object
  :start-x 20 :start-y 20
  :end-x 280 :end-y 100))

(capi:contain
 (make-instance
  'capi:right-angle-line-pinboard-object
  :start-x 20 :start-y 120
  :end-x 280 :end-y 200
  :type :horizontal-first))

See also
pinboard-layout
“Creating graphical objects” on page 187

row-layout

Class

Summary  A layout which arranges its children in a row.

Package  capi

Superclasses  grid-layout

Initargs

:ratios  The size ratios between the layout's children.

:adjust  The vertical adjustment for each child.

:gap  The gap between each child.

:uniform-size-p
  If t, each child in the row has the same width.

Accessors  layout-ratios
Description

The class row-layout lays its children out in a row. It inherits the behavior from grid-layout. The description is a list of the layout’s children, and the layout also translates the initargs ratios, adjust, gap and uniform-size-p into the grid layout’s equivalent arguments x-ratios, y-adjust, x-gap and x-uniform-size-p.

description may also contain the keywords :divider and :separator which automatically create a divider or separator as a child of the row-layout. The user can move a divider, but cannot move a separator.

When specifying :ratios in a row with :divider or :separator, you should use nil to specify that the divider or separator is given its minimum size.

Compatibility note

*layout-divider-default-size* and row-layout-divider are not supported in LispWorks 4.4 and later.

Example

(setq row (capi:contain (make-instance 'capi:row-layout :description (list (make-instance 'capi:push-button :text "Press me") (make-instance 'capi:title-pane :text "Title") (make-instance 'capi:list-panel :items '(1 2 3)) :adjust :center)))

(capi:apply-in-pane-process row #'(setf capi:layout-y-adjust) :bottom row)

(capi:apply-in-pane-process row #'(setf capi:layout-y-adjust) :top row)

This last example shows a row with a stretchable dummy pane between two other elements which are fixed at their minimum size. Try resizing it:
{capi:contain}  
{make-instance 'capi:row-layout  
 :description  
 (list (make-instance 'capi:push-button  
 :text "foo")  
     nil  
     (make-instance 'capi:push-button  
 :text "bar"))  
 :ratios '(nil 1 nil))}

See also column-layout  
“CAPI elements” on page 2  
“Button panel classes” on page 44  
Chapter 6, “Laying Out CAPI Panes”  
Chapter 7, “Programming with CAPI Windows”  
Chapter 10, “Defining Interface Classes - top level windows”

screen

Class

Summary A screen is an object that represents the known monitor screens.

Package capi

Superclasses capi-object

Subclasses color-screen
mono-screen

Initargs  
:width The width in pixels of the screen.  
:height The height in pixels of the screen.  
:number The screen number.  
:depth The number of color planes in the screen.  
:interfaces A list of all of the interfaces visible on the screen.
When the CAPI initializes itself it creates one or more screen objects and they are then used to specify where a window is to appear. A screen object can also be queried for information that the program may need to know about the screen that it is working on, such as its width, height and depth.

On Microsoft Windows and Cocoa there is exactly one CAPI screen. When there are multiple monitors, there are several rectangles of pixels within the single CAPI screen.

On Motif, there is one CAPI screen for each X11 screen.

In LispWorks for Macintosh 4.3 there is one CAPI screen for each Cocoa screen. In LispWorks for Macintosh 4.4 and later, there is exactly one CAPI screen.

Example

(setq screen (capi:convert-to-screen))
(capi:screen-width screen)
(capi:screen-height screen)
(capi:display (make-instance
              'capi:interface :title "Test")
              :screen screen)
(capi:screen-interfaces screen)

See also
convert-to-screen
“Screens” on page 36
“Dialog Owners” on page 162
Chapter 10, “Defining Interface Classes - top level windows”
screen-active-interface

**Summary**

Returns the active interface on a screen.

**Package**

capi

**Signature**

`screen-active-interface screen => interface`

**Arguments**

`screen`  A `screen` or `document-container`

**Values**

`interface`  An interface, or nil.

**Description**

The function `screen-active-interface` returns the currently active interface on the `screen screen`, or nil if no CAPI interface is active or if this cannot be determined.

`screen-active-interface` also works with `document-container`, returning the active interface within the container.

**See also**

document-container

screen

“Screens” on page 36

screen-active-p

**Summary**

Determines whether a screen is active.

**Package**

capi

**Signature**

`screen-active-p screen => result`

**Arguments**

`screen`  A screen.

**Values**

`result`  A boolean.
The function `screen-active-p` is the predicate for whether a screen is active.

A screen is normally "active". It can become inactive only when it "dies", which can happen on X interface (GTK+ or Motif) when the X connection get broken for any reason.

See also [screen](#) "Screens" on page 36

### screen-internal-geometries

**Function**

**Summary**

Returns the internal geometries of all the monitors of a screen.

**Package**

capi

**Signature**

`screen-internal-geometries screen => internal-geometries`

**Arguments**

`screen` A CAPI screen.

**Values**

`internal-geometries` A list of screen rectangles.

**Description**

The function `screen-internal-geometries` returns the internal geometries of all the "monitors" of screen. A "monitor" typically corresponds to a physical monitor, but can be anything that the underlying GUI system considers a monitor.

The internal geometry of a monitor is a rectangle which excludes "system areas" like taskbars and global menu bars and so on. Examples of these include the Windows taskbar, the Mac OS X menu bar, and the Mac OS X Dock. See `screen-internal-geometry` for information about displaying CAPI windows in system areas.
Each internal geometry is represented as a screen rectangle. A screen rectangle is a list of four numbers: \( x \) and \( y \) being the coordinates as offsets from the top-left of the primary monitor, and \( width \) and \( height \).

The first screen rectangle in the \textit{internal-geometries} list corresponds to the usable area of the primary monitor.

**Notes**

On GTK+ when using a desktop with separate workspaces, the workspaces may be considered as separate "monitors". When there are multiple real monitors, the values may be incorrect. You can use \texttt{screen-monitor-geometries} to check the number of monitors, and to check the full size of the monitors.

**See also**

\texttt{pane-screen-internal-geometry}

\texttt{virtual-screen-geometry}

\texttt{screen-internal-geometry}

\texttt{screen-monitor-geometries}

"Screens" on page 36

"Support for multiple monitors" on page 41

"Querying and modifying interface geometry" on page 151

---

**screen-internal-geometry**

**Function**

**Summary**

Returns the geometry of the unobscured region of a screen or document container.

**Package**

\texttt{capi}

**Signature**

\texttt{screen-internal-geometry screen \Rightarrow x, y, width, height}

**Arguments**

\texttt{screen}  
A screen.

**Values**

\( x \)  
An integer.

\( y \)  
An integer.
width  A positive integer.
height  A positive integer.

Description  The function `screen-internal-geometry` returns the geometry (as multiple values representing a screen rectangle) of the region of the screen that can be used to display windows without obstruction. This region excludes "system areas" like menubar and taskbar and so on. Examples of these include the Windows taskbar, the Mac OS X menu bar and the Mac OS X Dock.

\(x\) and \(y\) are the screen rectangle’s coordinates as offsets from the top-left of the primary monitor, and \(\text{width}\) and \(\text{height}\) are its dimensions.

On Microsoft Windows `screen-internal-geometry` works with `document-container`, returning the current size of the container (which may vary over time).

Notes  1. The internal geometry is a snapshot of the unobscured region of a screen. If a system area moves or changes size, then the screen rectangle returned by `screen-internal-geometry` changes.

2. It may be possible to display a CAPI window outside the screen’s internal geometry, for example under the Mac OS X Dock, but it will be obscured.

3. The primary monitor is that represented by the first screen rectangle in the list returned by `screen-internal-geometries`.

See also  `document-container`
`pane-screen-internal-geometry`
`screen`
`screen-internal-geometries`
“Screens” on page 36
“Support for multiple monitors” on page 41
“Querying and modifying interface geometry” on page 151
**screen-logical-resolution**  
*Function*  

**Summary**  
Returns the logical resolution of `screen`.  

**Package**  
capi  

**Signature**  
`screen-logical-resolution screen => xlogres, ylogres`  

**Arguments**  
`screen`  
A screen.  

**Values**  
`xlogres, ylogres`  
Integers representing the logical resolution of `screen` in DPI.  

**Description**  
The function `screen-logical-resolution` returns the logical resolution of `screen`, as dots per inch in the x and y directions.  

**See also**  
`screen`  
“Screens” on page 36

---

**screen-monitor-geometries**  
*Function*  

**Summary**  
Returns the geometries of all of a screen's monitors.  

**Package**  
capi  

**Signature**  
`screen-monitor-geometries screen => monitor-geometries`  

**Arguments**  
`screen`  
A CAPI screen.  

**Values**  
`monitor-geometries`  
A list of screen rectangles.
The function `screen-monitor-geometries` returns the geometries of all the monitors of screen. A monitor corresponds to an entity that the host machine regards as a physical monitor. `screen-monitor-geometries` ignores software manipulations like the desktop on GTK+.

The monitor geometry is a rectangle which includes all of its display area, including "system areas" like menubar and taskbar and so on. Examples of these include the Windows taskbar, the Mac OS X menu bar and the Mac OS X Dock.

Each monitor geometry screen rectangle is represented by a list of four numbers: the \(x\) and \(y\) coordinates as offsets from the top-left of the primary monitor, and the \(width\) and \(height\).

The first screen rectangle in the `monitor-geometries` list corresponds to the primary monitor.

**Notes**

1. `screen-monitor-geometries` differs from `screen-internal-geometries` by returning screen rectangles which include all the monitor areas, and also by ignoring desktop manipulations.

2. You cannot display a CAPI window on the Mac OS X menu bar. You can display a CAPI window in the area occupied by the Mac OS X Dock or the Windows taskbar, but the window will be obscured.

**See also**

- `pane-screen-internal-geometry`
- `screen-internal-geometries`
- `virtual-screen-geometry`
- “Screens” on page 36
- “Support for multiple monitors” on page 41
- “Querying and modifying interface geometry” on page 151

**screens**

**Function**

**Summary**

Returns the active screens for a library.
Package: capi

**screens** &optional library => result

Arguments:

- Library: A library name, a list, or :any.

Values:

- Result: A list.

Description:

The function `screens` returns as a list all the active screens for library.

A library name is a keyword naming a library, currently :win32 on Microsoft Windows, :gtk on GTK+, :motif on Motif and :cocoa on Mac OS X with the native GUI.

library can be a library name, or a list of library names, or the keyword :any, meaning all the libraries. The default value of library is the result of `default-library`.

See also:

- `default-library`
- `screen`
- “Screens” on page 36

---

**scroll**  

*Generic Function*

Summary:

Moves the scrollbar and calls the `scroll-callback`.

Package: capi

Signature:

`scroll` self scroll-dimension scroll-operation scroll-value &rest options

Arguments:

- Self: A pane that supports scrolling.
- Scroll-dimension: :vertical, :horizontal or :pan.
scroll-value  An integer, or a list of two integers, or a keyword, or a list of two keywords.

options  A list.

Description  The generic function scroll works for panes that support scrolling - these are subclasses of output-pane and layout.

scroll moves the scrollbar of a scrollable pane according to scroll-dimension, scroll-operation and scroll-value. It then calls the scroll-callback (see output-pane) with these arguments and options.

scroll-dimension determines whether the scrolling is vertical, horizontal or, if the value is :pan, in both dimensions.

scroll-operation determines the extent of the scroll. The value :move means that the pane scrolls to the position on the scroll range given by scroll-value, regardless of the current scroll position. The value :step means scroll from the current scroll position by scroll-value times the scroll step size. In the case of panes which do their own scrolling the scroll step size is determined by the operating system (OS). In the case of panes for which the CAPI computes the scroll, the scroll step size is as described in with-geometry. The value :page means scroll from the current scroll position by scroll-value times the scroll page size (which is also determined by the OS or the pane’s geometry).

scroll-value should be an integer or keyword if scroll-dimension is :horizontal or :vertical. Allowed keyword values are :start and :end. scroll-value should be a list of two integers or keywords representing the horizontal and vertical scroll values if scroll-dimension is :pan.

options is a list containing arbitrary user data.

Compatibility note  scroll supersedes set-scroll-position, which is deprecated and no longer exported. The call

(capi:scroll pane :pan :move (list x y))
is equivalent to

(capi:set-scroll-position pane x y)

See also

ensure-area-visible
get-scroll-position
output-pane
set-horizontal-scroll-parameters
set-vertical-scroll-parameters
with-geometry
Chapter 7, “Programming with CAPI Windows”

scroll-bar

Class

Summary

A pane which displays a scroll bar.

Package
capi

Superclasses
range-pane
simple-pane
titled-object

Initargs

:line-size The distance scrolled by the scroll-line gesture.
:page-size The distance scrolled by clicking inside the scroll bar.
:callback A function called after a scroll gesture, or nil.

Accessors

scroll-bar-line-size
scroll-bar-page-size

Description

The class scroll-bar implements panes which display a scroll bar and call a callback when the user scrolls. It is not however the most usual way to add scroll bars - see the note below about simple-pane.
line-size is the logical size of a line, and is the distance moved when the user enters a scroll-line gesture, that is clicking on one of the arrow buttons at either end of the scroll bar or using a suitable arrow key. The default value of line-size is 1.

page-size is the logical size of a page, and is the distance moved when the user clicks inside the scroll bar. The default value of page-size is 10.

callback can be nil, meaning there is no callback. This is the default value. Otherwise, is a function of four arguments, the interface containing the scroll-bar, the scroll-bar itself, the mode of scrolling and the amount of scrolling. It has this signature:

callback interface scroll-bar how where

how can be one of :line, :page, :move, or :drag.

If how is :line, then where is an integer indicating how many lines were scrolled.

If how is :page, then where is an integer indicating how many pages were scrolled.

If how is :move or :drag, then where is an integer giving the new location of the slug-start, or :start or :end.

Notes
1. The location of the slug can be found by the range-pane accessor range-slug-start.
2. Rather than using scroll-bar, it is more usual to add scroll bars to a pane by the simple-pane initargs :horizontal-scroll and :vertical-scroll.
Example

(defun sb-callback (interface sb how where)
  (declare (ignorable interface))
  (format t "Scrolled -a where -a : -a-%" how where (range-slug-start sb)))

(contain
  (make-instance 'capi:scroll-bar
    :callback 'sb-callback
    :page-size 10
    :line-size 2
    :visible-min-width 200))

See also

simple-pane

“Slider, Progress bar and Scroll bar” on page 29

scroll-if-not-visible-p

Generic Function

Summary

Accesses the scroll-if-not-visible-p attribute of a pane.

Signature

scroll-if-not-visible-p pane => value
(setf scroll-if-not-visible-p) value pane

Values

value

One of t, nil or :non-mouse.

Method Signature

scroll-if-not-visible-p simple-pane
(setf scroll-if-not-visible-p) value simple-pane

Description

The generic function scroll-if-not-visible-p accesses the scroll-if-not-visible-p attribute of a pane. The value of this attribute has these meanings:

**t**

When pane is given the input focus, and it is not fully visible, and its parent can be scrolled to make the pane visible, then the parent is scrolled automatically. This is the default value.
nil

Never scroll the parent to make a pane visible.

:non-mouse

Like t, except that it does not scroll when the focus is given as a result of a mouse click in pane.

scroll-if-not-visible-p is called by CAPI each time it may need to scroll the parent. The method on simple-pane returns a value that is kept internally, and can be set by the default setf method.

You can specialize scroll-if-not-visible-p on your classes, but note that it is called often when the user clicks on any pane, so it must be reasonably fast.

The setter sets the scroll-if-not-visible-p attribute. It is called when the initarg :scroll-if-not-visible-p is used in making a simple-pane (or a subclass) instance, and can be called by your program. value must be t, nil or :non-mouse.

The method on simple-pane sets the internal value that is used by scroll-if-not-visible-p on simple-pane.

See also

simple-pane

Chapter 7, “Programming with CAPI Windows”

---

**search-for-item**

**Generic Function**

**Summary**

The generic function search-for-item returns the index of an item in a collection.

**Package**

capi

**Signature**

search-for-item collection item

**Description**

Returns the index of item in the collection, using the collection-test-function to determine equality, and returns nil if no match is found.
The search is done by sequentially comparing item to each item in collection using the collection’s test-function, which is cl: eq by default.

search-for-item is the counterpart function to get-collection-item which given an index, finds the appropriate item.

See also get-collection-item
collection

### selection

**Function**

#### Summary

Returns the primary selection.

#### Package
capi

#### Signature

`selection self &optional format => result`

#### Arguments

- `self` A displayed CAPI pane or interface.
- `format` A keyword.

#### Values

- `result` A string, an image, a Lisp object, or nil.

#### Description

The function `selection` returns the contents of the primary selection as a string, or nil if there is no selection.

`format` controls what kind of object is read. The following values of `format` are recognized:

- **:string** The object is a string. This is the default value.
- **:image** The object is of type image, converted from whatever format the platform supports.
- **:value** The object is the Lisp value.
When \textit{format} is \texttt{:image}, the image returned by \texttt{selection} is associated with \texttt{self}, so you can free it explicitly with \texttt{free-image} or it will be freed automatically when the pane is destroyed.

On Microsoft Windows there is no notion of selection, so this mechanism is internal to Lisp.

Note that X applications may or may not use the primary selection for their paste operations. For instance, Emacs is configurable by the variable \texttt{interprogram-paste-function}.

See also \texttt{clipboard} \texttt{free-image} \texttt{image} \texttt{selection-empty} \texttt{set-selection} “Clipboard” on page 265

\begin{Verbatim}
\textbf{selection-empty} \hspace{1cm} \textit{Function}
\end{Verbatim}

\textbf{Summary} \hspace{0.5cm} Determines whether there is a primary selection of a particular kind.

\textbf{Package} \hspace{0.5cm} \texttt{capi}

\textbf{Signature} \hspace{0.5cm} \texttt{selection-empty self \&optional format => result}

\textbf{Arguments} \hspace{0.5cm} \\
\texttt{self} \hspace{1cm} A displayed CAPI pane or interface. \\
\texttt{format} \hspace{1cm} A keyword.

\textbf{Values} \hspace{0.5cm} \\
\texttt{result} \hspace{1cm} \texttt{t} or \texttt{nil}.

\textbf{Description} \hspace{0.5cm} The function \texttt{selection-empty} returns \texttt{nil} if there is a primary selection of the kind indicated by \texttt{format}, or \texttt{t} if there is no such selection.
format controls what kind of object is checked. The following values of format are recognized:

: string The object is a string. This is the default value.

: image The object is of type image, converted from whatever format the platform supports.

: value The object is the Lisp value.

See also image
selection
“Clipboard” on page 265

set-application-interface

Function

Summary Specifies the main Cocoa application interface.

Package capi

Signature set-application-interface interface

Arguments interface An object of type cocoa-default-application-interface

Description The function set-application-interface sets interface as the main application interface. This interface is used to supply the application menu and receives various callbacks associated with the application.

set-application-interface must be called before any CAPI functions that make the screen object (such as convert-to-screen and display).

interface should not be displayed like a normal interface.
An application can only have one application menu and one
dock menu. Because the LispWorks IDE already provides
these menus, calling `set-application-interface` while
running the LispWorks IDE will add a submenu to the `Lisp-
Works` application menu to contain the `application-menu` and
`menu-bar-items` of your application, and you can test them
there. Likewise, a submenu will be added to the LispWorks
Dock icon menu. Other aspects of the application interface
can only be tested when running it standalone.

`set-application-interface` is only applicable when run-
ning under Cocoa.

Examples

```lisp
(ex example-edit-file "capi/applications/cocoa-
application")

(ex example-edit-file "capi/applications/cocoa-
application-single-window")

(ex example-edit-file "delivery/macos/multiple-window-
application")

(ex example-edit-file "delivery/macos/single-window-
application")
```

See also `cocoa-default-application-interface`

### set-button-panel-enabled-items

**Generic Function**

**Summary**
Sets the enabled state of the items in a button panel.

**Package**
capi

**Signature**
`set-button-panel-enabled-items button-panel &key enable`  
disable set test key

**Description**
The generic function `set-button-panel-enabled-items` sets the enabled state of the items in a button panel. If `set` is `t`, then `enable` is ignored and all items are enabled except those in the `disable` list. If `set` is `nil`, `disable` is ignored and all items
are disabled except those in the enable list. If set is not given, the items in the enable list are enabled and the items in the disable list are disabled. If an item is in both lists, it is enabled. A button is in a list when the data of the button matches one of the items in the list. A match is defined as a non-nil return value from the test function. The default test function is cl:equal.

See also

- button-panel
- redisplay-interface

**set-clipboard**

**Function**

**Summary**
Sets the contents of the system clipboard.

**Package**
capi

**Signature**

```
set-clipboard self value &optional string plist => result
```

**Arguments**

- **self**
  A displayed CAPI pane or interface.
- **value**
  A Lisp object (not necessarily a string) to make available within the local Lisp image.
- **string**
  The string representation of value to export, or nil. If nil and value is a string, then that will be exported as the string.
- **plist**
  A property list of additional format/value pairs to export. The currently supported formats are as described for clipboard. You can export more than one format simultaneously.

**Values**

- **result**
  A string, or nil.

**Description**

The function set-clipboard sets the contents of the system clipboard to be the text of string.
In Microsoft Windows applications (including LispWorks in Windows emulation mode), the contents of the system clipboard is usually accessed by the user with the Ctrl+V gesture.

The X clipboard can be accessed by the Ctrl+V gesture in KDE/Gnome emulation, or by running the program xclipboard or the Emacs function x-get-clipboard. The most likely explanation for apparent inconsistencies after set-clipboard is that the pasting application does not use the X clipboard.

In Cocoa applications (including LispWorks), the contents of the system clipboard is usually accessed by the user with the Command+V gesture.

Example
To export an image:

```lisp
(capi:set-clipboard pane nil nil (list :image image))
```

To export an image with a text description

```lisp
(capi:set-clipboard pane nil nil
  (list :image image
        :string "my image"))
```

See also
- clipboard
- selection
- text-input-pane-copy
- “Clipboard” on page 265

**set-composition-placement**

*Function*

**Summary**

Specifies the placement of the composition window relative to the pane. Composition here mean composing input characters into other characters by an input method.

**Signature**

```
set-composition-placement pane x y &key width height force
```
Description

The function `set-composition-placement` tells the system where to place the composition window in pixel coordinates relative to the pane `pane`.

On systems where the composition text is displayed by the application (rather than by the system, when the composition callback is called with a plist), the placement coordinates are used to place the composition menu when it is raised.

$x$ and $y$ are the top left coordinates. If both $width$ and $height$ are supplied, they specify the dimensions of the composition window. If `force` is supplied with a true value, the coordinates are forced, overriding adjustments that the system may otherwise do.

$x$, $y$ and, when supplied, $width$ and $height$ must all be positive integers.

Notes

`set-composition-placement` does not raise the composition window. It merely tells the system where to place the composition window when it does appear.

See also

- `output-pane`
- `output-pane-stop-composition`
- “Composition of characters” on page 187

**set-confirm-quit-flag**

**Function**

Summary Controls the behavior of `confirm-quit`.

Package `capi`

Signature `set-confirm-quit-flag flag`

Arguments `flag` One of `t`, `nil` or `:check-editor-files`

Description The function `set-confirm-quit-flag` sets a flag which controls the behavior of `confirm-quit`. 
See confirm-quit for the effect.

Note: on initialization, the LispWorks IDE sets the flag to the stored value of the option Tools > Preferences... > Environment > General > Confirm Before Exiting.

See also confirm-quit

**set-default-editor-pane-blink-rate**

*Function*

**Summary**

Sets the default cursor blinking rate for editor panes.

**Package**

capi

**Signature**

set-default-editor-pane-blink-rate blink-rate

**Arguments**

blink-rate A non-negative real number, or nil.

**Description**

The function set-default-editor-pane-blink-rate sets the default to use for the editor pane cursor blinking rate. This default value is used when editor-pane-blink-rate returns nil.

Initially the setting is if this call has been made:

(set-default-editor-pane-blink-rate nil)

This means that the native blink rate will be used.

The argument blink-rate is interpreted as a blinking rate as described in editor-pane-blink-rate.

See also editor-pane-blink-rate

editor-pane-native-blink-rate
**set-default-interface-prefix-suffix**

*Function*

**Summary**
Sets the default suffix and prefix that are added to each interface title.

**Package**
capi

**Signature**

```
(defun set-default-interface-prefix-suffix &key prefix suffix
  child-prefix child-suffix => prefix, suffix, child-prefix, child-suffix)
```

**Arguments**

- **prefix**: A string or **nil**.
- **suffix**: A string or **nil**.
- **child-prefix**: A string or **nil**.
- **child-suffix**: A string or **nil**.

**Values**

- **prefix**: A string or **nil**.
- **suffix**: A string or **nil**.
- **child-prefix**: A string or **nil**.
- **child-suffix**: A string or **nil**.

**Description**

The function `set-default-interface-prefix-suffix` sets the global default suffix and prefix that are added to each interface title. The prefix and suffix are added by the default method of `interface-extend-title`.

If `prefix, suffix, child-prefix` or `child-suffix` are supplied, their value must be either a string or **nil**. If any of them is not passed, the corresponding previously set value is not changed.

`prefix` and `suffix` specify the prefix and suffix to use for interfaces that are children of a `screen` object. These values do not affect `child-prefix` and `child-suffix`. 
child-prefix and child-suffix specify the prefix and suffix to use for interfaces that are not children of a screen object, such as an interface inside a Multiple Document Interface (MDI) window. These values do not affect prefix and suffix.

The return values are the settings of the prefix, suffix, child prefix and child suffix after the call.

To check the current settings, call set-default-interface-prefix-suffix with no arguments. This does not change the current settings.

Before setting the title on a window on the screen, the system calls interface-extend-title with the interface and the title of the interface, and uses the result for the actual title. The default method of interface-extend-title checks prefix and suffix (or child-prefix and child-suffix for MDI) as were set by set-default-interface-prefix-suffix, and if they are non-nil adds the value to the title.

set-default-interface-prefix-suffix can be called after some windows are displayed. It automatically updates all current interface windows as if by calling update-all-interface-titles.

Example

If you work in an environment when it is not always obvious on which machine your image is running, you can add the name of the machine to all windows by:

(capi:set-default-interface-prefix-suffix :suffix (format nil "-- ~a" (machine-instance)))

See also

interface-extend-title
update-all-interface-titles
“Window titles” on page 18
“Controlling the appearance of the top level window” on page 150
set-default-use-native-input-method  

**Function**

**Summary**  Controls the default of using native input method on GTK+.

**Signature**  

```
set-default-use-native-input-method &key output-pane  
editor-pane => t  
```

**Arguments**  

- `output-pane`  A boolean.
- `editor-pane`  A boolean.

**Values**  

`set-default-use-native-input-method` returns `t`.

**Description**  The function `set-default-use-native-input-method` controls whether the native input method is used by default. Currently it has an effect only on GTK+.

The values of the keyword arguments are booleans. `editor-pane` changes the default for `editor-pane` and subclasses. `output-pane` controls the default for `output-pane` and subclasses, except `editor-pane` and its subclasses.

If a keyword argument is not supplied, the corresponding default is not set.

**See also**  

- `output-pane`  
- `editor-pane`  

“Native input method” on page 187

---

set-display-pane-selection  

**Generic Function**

**Summary**  Sets the selection in a `display-pane`.

**Package**  `capi`

**Signature**  

```
set-display-pane-selection pane start end  
```

**Arguments**  

- `pane`  A `display-pane`. 
**Description**
The generic function `set-display-pane-selection` sets the selection in `pane` to be the text bounded by the indexes `start` (inclusive) and `end` (exclusive).

**See also**
- `display-pane-selection`
- `display-pane`

---

**set-drop-object-supported-formats**

**Function**

**Summary**
Sets the list of formats for a drop object

**Package**
capi

**Signature**
`set-drop-object-supported-formats drop-object formats`

**Arguments**
- `drop-object` A drop-object, as passed to the drop-callback
- `formats` A list of format keywords

**Description**
The function `set-drop-object-supported-formats` sets the list of formats that the drop object `drop-object` wants to receive.

The format `:string` can be used to receive a string from another application and the `:filename-list` format can be used to receive a list of filenames from another application such as the Macintosh Finder or the Windows Explorer.

GTK+ supports dragging of list of URIs. LispWorks uses a list of URIs to pass/receive the data with the format `:filename-list`, and also adds the format `:uris`. The behavior is as follows:
• For dragging with format :filename-list (that is, call drag-pane-object with a plist containing :filename-list, or including :filename-list in the value that drag-callback returns) the argument must be a list of pathname designators. LispWorks canonicalizes the pathnames and converts them to file URIs.

• For dragging with format :uris, each value in the list must either a string containing a colon, or a pathname designator. A string containing a colon is passed unchanged. Other it is assumed to be a pathname designator, and is converted to a file URI.

• For dropping with format :filename-list (that is, calling drop-object-get-object with :filename-list), LispWorks converts each file URI to the corresponding filename string (without checking whether it is a proper file name), and discards all other URIs.

• For dropping with format :uris, LispWorks returns all the URIs as strings.

There is an example of :filename-list and :uris here:

(example-edit-file "capi/elements/gtk-filename-list-and-uris")

On Cocoa and GTK+ the :image format can be used to receive images. The value passed needs to be an image object.

Any other keyword in formats is assumed to be a private format that can only be used to receive objects from with the same Lisp image.

Notes

set-drop-object-supported-formats should only be called within a drop-callback. See simple-pane for information about drop callbacks.

Example

(example-edit-file "capi/output-panes/drag-and-drop")

(example-edit-file "capi/choice/drag-and-drop")
See also drop-object-provides-format
simple-pane
Chapter 17, “Drag and Drop”

set-editor-parenthesis-colors

Function

Summary
Sets the colors that are used for parenthesis coloring.

Signature
set-editor-parenthesis-colors colors

Arguments
colors A list of colors, t or nil.

Description
The function set-editor-parenthesis-colors sets the colors that are used for parenthesis coloring in an editor-pane in Lisp mode.

If colors is a non-nil list, each of its elements must be a valid color specification or a defined color alias. See Chapter 15, “The Color System” for information about color specifications and aliases.

If it is called when CAPI is running, set-editor-parenthesis-colors checks that the colors are valid. If it is called when CAPI is not running, set-editor-parenthesis-colors does not check the colors, and a bad color will cause an error later. The colors have an effect only on coloring that happens after the call.

If colors is t or nil, parenthesis coloring is switched on or off, without changing the list of colors.

When parenthesis coloring is off, parentheses are drawn like other characters.

See also editor-pane
set-geometric-hint

Summary
Sets a hint.

Package
capi

Signature
set-geometric-hint element key value &optional override

Description
The function set-geometric-hint sets the hint associated with key to value.
If override is nil, the value is not changed when there is already a hint for this key. The default is t.

See also
set-hint-table
element

set-hint-table

Summary
Modifies the hint table for an element.

Package
capi

Signature
set-hint-table element plist

Description
The function set-hint-table modifies the hint table for the element element to include plist. All existing hints are retained for keys not in the plist.
This may or may not change the on-screen geometry. To change the geometry of an interface, use set-top-level-interface-geometry.

Notes
If a hint keyword is repeated in plist, the first value is used.
set-horizontal-scroll-parameters

Summary
Allows programmatic control of the parameters of a horizontal scroll bar.

Package
capi

Signature
set-horizontal-scroll-parameters self &key min-range max-range slug-position slug-size page-size step-size

Description
The function set-horizontal-scroll-parameters sets the specified parameters of the horizontal scroll bar of self, which should be a displayed instance of a subclass of output-pane (such as editor-pane) or layout.

The other arguments are:
min-range The minimum data coordinate.
max-range The maximum data coordinate.
slug-position The current scroll position.
slug-size The length of the scroll bar slug.
page-size The scroll page size.
step-size The scroll step size.

When one of these keyword arguments is not supplied, the value of the corresponding scroll parameter in self is not modified.

See “Scroll values and initialization keywords” on page 100 for a description of these scroll parameters.
The function `set-horizontal-scroll-parameters` supersedes the function `set-scroll-range`, which is deprecated and no longer exported.

The call

```
(set-horizontal-scroll-parameters pane :min-range 0 :max-range 42)
```

is equivalent to

```
(set-scroll-range pane 42 nil)
```

Example

```
(example-edit-file "capi/output-panes/scroll-test")
(example-edit-file "capi/output-panes/scrolling-without-bar")
```

See also

- `scroll`
- `get-horizontal-scroll-parameters`
- `get-vertical-scroll-parameters`
- `set-vertical-scroll-parameters`
- `simple-pane`

Chapter 7, “Programming with CAPI Windows” “output-pane scrolling” on page 199

---

**set-interactive-break-gestures**

*Function*

**Summary**
Sets the break gestures on GTK+ and Motif.

**Signature**

```
set-interactive-break-gestures gestures => result
```

**Arguments**

- `gestures` A list of gesture specifiers, or `t`

The function `set-interactive-break-gestures` sets the gestures that can be used to break by typing at an interface.

`gestures` is a list of gesture specifiers. A gesture specifier is an object that `sys:coerce-to-gesture-spec` can recognize.
When an interface is created, the break gestures are set such that typing any one of them when the interface is on top causes an "interface break". This means that, if the interface process is busy, it tries to break it. In a Listener tool, it tries to break the REPL. Otherwise it tries to find a process that appears busy, and breaks that. In the LispWorks IDE, if there is no busy process it raises the Process Browser tool. Otherwise it breaks the current process.

set-interactive-break-gestures always returns the list of interactive break gestures.

gestures can also be t, which means do not change the gestures. This is useful to get the current list.

Notes

1. set-interactive-break-gestures has an effect only on GTK+ and Motif.

2. set-interactive-break-gestures has no effect on interfaces that are already created.

3. On GTK+ the list can be overridden by the resources file as illustrated in examples/gtk/gtkrc-break-gestures

set-list-panel-keyboard-search-reset-time

Function

Summary
Sets the default length of time before resetting the "last match" in keyboard searching in a list-panel.

Signature
set-list-panel-keyboard-search-reset-time time

Arguments

Arguments

time A positive real number.

Description
The function set-list-panel-keyboard-search-reset-time sets the default length of time before resetting the "last match" in keyboard searching in a list-panel. The argument time specifies this time in seconds.
When the user types a character into a **list-panel**, if there is a "last match" the system searches for a string made of the "last match" followed by the character, otherwise it searches for a string made of the character only. The system sets the "last match" when it matches, and remembers the "last match" for one second by default. **set-list-panel-keyboard-search-reset-time** can be used to change the time for which the "last match" is kept.

**Notes**

When **keyboard-search-callback** returns a third value non-nil, the value that **set-list-panel-keyboard-search-reset-time** sets is ignored.

**See also**

- **list-panel**
- **list-panel-search-with-function**
  
  "Searching by keyboard input" on page 54

---

**set-object-automatic-resize**

**Function**

**Summary**

Controls automatic resizing and repositioning of objects in a static layout.

**Package**

capi

**Signature**

```lisp
set-object-automatic-resize object &key x-align y-align x-offset y-offset x-ratio y-ratio width-ratio height-ratio aspect-ratio aspect-ratio-y-weight pinboard
```

**Arguments**

- **object**
  
  A **pinboard-object** or a **simple-pane**.

- **x-align**
  
  nil, :left, :center or :right.

- **y-align**
  
  nil, :top, :center or :bottom.

- **x-offset**
  
  A real number, default value 0.

- **y-offset**
  
  A real number, default value 0.

- **x-ratio**
  
  A positive real number or nil.
y-ratio  A positive real number or nil.
width-ratio  A positive real number or nil.
height-ratio  A positive real number or nil.
aspect-ratio  A positive real number, t or nil.
aspect-ratio-y-weight  A real number, default value 0.5.

Description

The function set-object-automatic-resize arranges for object to be resized and/or re-positioned automatically when pinboard is resized, or removes such a setting.

The value of aspect-ratio can be t, which means use the current aspect ratio of object (that is, its height divided by its width).

object should be either a pinboard-object or a simple-pane which is (or will be) displayed in a static-layout. This object will be added to the description of the layout by one of its :description initarg, (setf capi:layout-description) or manipulate-pinboard.

pinboard is the layout for object. If pinboard is already displayed with object in its description, the argument pinboard can be omitted.

When pinboard is resized, object is resized if either height-ratio or width-ratio are set.

The new width of object is calculated as follows:

- If width-ratio, height-ratio and aspect-ratio are all set, the new width is the width of pinboard multiplied by width-ratio, and then modified as described below.
• If width-ratio is set and either height-ratio or aspect-ratio is not set, the new width is the width of pinboard multiplied by width-ratio.

• If width-ratio is not set, and both height-ratio and aspect-ratio are set, the new width is the new height divided by aspect-ratio.

• Otherwise, the new width is the same as the old width.

The new height of object is calculated as follows:

• If width-ratio and aspect-ratio are set, the new height is the new width multiplied by the aspect ratio. Note that if height-ratio is set, the new width will depend on height-ratio too.

• If height-ratio is set and either width-ratio or aspect-ratio are not set, the new height is the height of pinboard multiplied by height-ratio.

• If height-ratio is not set, but both width-ratio and aspect-ratio are set, the new height is the new width multiplied by aspect-ratio.

• Otherwise, the new height is the same as the old height.

If all of width-ratio, height-ratio and aspect-ratio are set, the new width and height of object are calculated as follows:

1. Compute calculated-width as the width of pinboard multiplied by width-ratio, and calculated-height as the height of pinboard multiplied by height-ratio.

2. Compute aspect-ratio-ratio as

\[
\left(\frac{\text{calculated-height}}{\text{calculated-width}}\right) \times \text{aspect-ratio}
\]

3. Compute correction as

\[
\text{correction} = \text{expt} \left(\frac{\text{aspect-ratio-ratio}}{\text{aspect-ratio-y-weight}}\right)
\]

4. Compute the new width as calculated-width multiplied by correction, and the new height as the new width multiplied by aspect-ratio.
The result is that if \textit{aspect-ratio-y-weight} is 0, \textit{correction} is 1 and \textit{height-ratio} is effectively ignored, while if \textit{aspect-ratio-y-weight} is 1, \textit{correction} cancels the effect of \textit{width-ratio}. With the default value of 0.5, the resulting position is in the (geometric) middle, and \textit{object} takes a fixed fraction of the area of the pinboard.

After resizing (if needed), \textit{object} is also positioned horizontally if \textit{x-align} is non-nil, and vertically if \textit{y-align} is non-nil.

The new \textit{x} coordinate of \textit{object} is calculated as follows:

- If \textit{x-ratio} is set, the new \textit{x} coordinate is the sum of \textit{x-ratio} multiplied by the width of \textit{pinboard} plus \textit{x-offset}, otherwise it is simply \textit{x-offset}.

- The actual value of the \textit{x} coordinate for \textit{object} is adjusted according to the value of \textit{x-align} such that the left, center or right of \textit{object} align with the new coordinate.

The new \textit{y} coordinate of \textit{object} is calculated similarly, using \textit{y-ratio} and \textit{y-offset}, with an adjustment such that the top, center or bottom of \textit{object} aligns with the new coordinate according to \textit{y-align}.

If all of \textit{width-ratio}, \textit{height-ratio}, \textit{x-align} and \textit{y-align} are \texttt{nil}, automatic resizing/re-positioning of \textit{object} is removed.

\texttt{set-object-automatic-resize} can be called before \textit{object} is actually displayed, and its effect persists over calls adding and removing \textit{object} to/from \texttt{static-layouts}. The effect of \texttt{set-object-automatic-resize} also persists if \textit{object} is removed and added again, either to the same layout or another layout.

Repeated calls to \texttt{set-object-automatic-resize} set only the values that are passed to \texttt{set-object-automatic-resize}. Keys that are not passed are left with their previous value. A call that removes the automatic resizing (because \textit{width-ratio}, \textit{height-ratio}, \textit{x-align} and \textit{y-align} are all \texttt{nil}) erases all the values.
`set-object-automatic-resize` returns `t` if the object is set up for automatic resizing, or `nil` if the object is set up for no automatic resizing.

**Notes**

1. The initarg `:automatic-resize` can be used to set up automatic resizing in the call to `make-instance`.

2. The name `set-object-automatic-resize` is slightly inaccurate, because this function can alter an object’s position without actually changing its size.

**Compatibility note**

In LispWorks 6.0 the effect of `set-object-automatic-resize` does not persist if the object is removed and then added, to any layout.

In LispWorks 6.0 each call to `set-object-automatic-resize` sets all the values.

**Example**

Put an object of fixed size at the top right corner:

```lisp
(set-object-automatic-resize object
   :x-ratio 1 :x-align :right)
```

Put an object in the bottom-right quadrant:

```lisp
(set-object-automatic-resize
   object
   :x-ratio 0.5 :y-ratio 0.5
   :width-ratio 0.5 :height-ratio 0.5)
```

Put an object with a fixed aspect ratio and object width linear with the width of the layout in the center:

```lisp
(set-object-automatic-resize
   object
   :x-align :center :y-align :center
   :x-ratio 0.5 :y-ratio 0.5
   :aspect-ratio 0.6 :width-ratio 0.1)
```

There is a further example in

```lisp
(example-edit-file "capi/layouts/automatic-resize")
```
See also manipulate-pinboard
static-layout
pinboard-object
simple-pane

set-pane-focus

Generic Function

Summary
Sets the input focus to a pane.

Package
capi

Signature
set-pane-focus pane

Arguments
pane An instance of a subclass of simple-pane or choice.

Description
The function set-pane-focus sets the input focus to pane or one of its children.

See also pane-has-focus-p
“Focus” on page 14

set-printer-metrics

Function

Summary
Sets the metrics in the given printer.

Package
capi

Signature
set-printer-metrics printer &key left-margin top-margin width height

Description
The function set-printer-metrics sets the left margin and top margin, and the printable width and printable height, of the given printer. Values outside the bounds of the printer will be corrected.
Example

To set the margins as large as possible:

```lisp
(let ((metrics (capi:get-printer-metrics printer)))
  (capi:set-printer-metrics printer
    :left-margin 0
    :top-margin 0
    :width (capi:printer-metrics-paper-width metrics)
    :height (capi:printer-metrics-paper-height metrics)))
```

Actually this sets the margins to the whole paper size, but the printer driver will move these in to take account of the minimum margins of the device.

See also

- `get-printer-metrics`
- `set-printer-options`
- `print-dialog`

“Printing from the CAPI—the Hardcopy API” on page 249

---

### set-printer-options

**Function**

**Summary**

Sets various options in the given printer.

**Package**

capi

**Signature**

`set-printer-options printer &key output-file first-page last-page orientation copies`

**Description**

The function `set-printer-options` allows some printer options for the current job to be set programmatically. Note that the user can change the various printer options in the dialog displayed by `print-dialog`.

The `printer` argument should be a printer object returned by `current-printer` or `print-dialog`. This `printer` should then be passed to `with-print-job` to print using the options specified.
The keyword arguments control which options are set. If a keyword is not passed then the option remains unchanged.

Values of output-file are:

- **nil**: Print directly to the device.
- **t**: Print to a file chosen by the user at printing time.
- **A pathname**: Print to the file given by pathname.

Values of first-page are:

- **:all**: Print all pages.
- **An integer**: Print from this page to the page given by last-page.

Values of orientation are:

- **:landscape**: Print in landscape mode.
- **:portrait**: Print in portrait mode.

Values of copies:

- **An integer**: The number of copies to print.

**Notes**

Printer objects cannot be reused after changing their options or metrics. Call current-printer after set-printer-options to get a new printer object containing the latest settings.

**Example**

```lisp
;; Print two copies to the current printer.
(let ((printer (capi:current-printer)))
  (capi:set-printer-options printer :copies 2)
  (capi:with-print-job (port :printer printer)
    (print-my-document port)))
```

**See also**

- print-dialog
- current-printer
- with-print-job

“Printing from the CAPI—the Hardcopy API” on page 249
**set-rich-text-pane-character-format**  

**Function**

**Summary**
Sets the character format.

**Package**
capi

**Signature**

```scheme
set-rich-text-pane-character-format pane &key selection
attributes-plist => result
```

**Arguments**

- `pane`  
  A rich-text-pane.

- `selection`  
  Must be `t`. This argument is deprecated.

- `attributes-plist`  
  A plist or `:default`.

**Values**

- `result`  
  A plist.

**Description**
The function `set-rich-text-pane-character-format` sets the current character attributes for text in `pane`.

If there is a current selection in the pane, then the attributes are set for the selected text. If there is no selection, then it sets the "typing attributes", which are applied to characters that are typed by the user. Note that any cursor movement changes these attributes, so the setting is ephemeral.

The `selection` argument is deprecated. If `selection` is `nil` an error is signalled. The default value of `selection` is `t`.

If `attributes-plist` is the symbol `:default` then the default character format of the pane (that is, the value of the `rich-text-pane initarg :character-format`) is used. Otherwise `attributes-plist` is a plist of keywords and values. These are the valid keywords on Microsoft Windows and Cocoa:

- `:bold`  
  A boolean.

- `:italic`  
  A boolean.

- `:underline`  
  A boolean.

- `:face`  
  A string naming a font.
:color       A color spec or alias specifying the foreground color.
:size        The size of the font.

Additionally these attributes-plist keywords are valid on Microsoft Windows only:

:strikeout   A boolean.
:offset      An integer specifying the vertical offset of characters from the line (a positive value makes them superscript and a negative value makes them subscript).
:protected   A boolean. See the description of protected-callback in rich-text-pane.
:charset     A cons (charset . pitch-and-family) where charset has the value of a Microsoft Windows charset identifier, and pitch-and-family is the value of (logior pitch family) where pitch and family have the value of a Windows pitch and a Windows font family respectively.

Compatibility note

The value nil for the keyword argument :selection is not supported in LispWorks 6.1 and later. See the description above for details of the current behavior with respect to the current selection in the rich-text-pane.

Example

Note: This example uses some features which are supported only on Microsoft Windows:
(defun ok-to-edit-p (pane start end s)
  (declare (ignore pane))
  (capi:prompt-for-confirmation
   (format nil "Editing:~{ ~; selection ~\}from ~a to ~a" s start end)))

(setq rtp
  (capi:contain
   (make-instance
    'capi:rich-text-pane
    :protected-callback 'ok-to-edit-p
    :character-format
    '(:size 14 ;color :red)
    :visible-min-height 300
    :visible-min-width 400
    :paragraph-format
    '(:start-indent 20 ;offset -15)
    :text-limit 160
    :text (format nil "First paragraph.~%Second paragraph, a little longer.~%Another paragraph, which should be long long enough that it spans more than one line. ~%" ))))

Enter some characters in the rich text window and select a range.

Set the selection to blue:

(capi:set-rich-text-pane-character-format rtp
 :attributes-plist '(:color :blue))

Make it protected:

(capi:set-rich-text-pane-character-format rtp :attributes-plist '(:protected t))

Now try to delete a character, and also to delete the selection. In both cases the ok-to-edit-p callback is called.

See also
rich-text-pane
rich-text-pane-character-format
**set-rich-text-pane-paragraph-format**  

**Function**

**Summary** Sets the paragraph format.

**Package** capi

**Signature**

```
set-rich-text-pane-paragraph-format pane attributes-plist => result
```

**Arguments**

- `pane` A rich-text-pane.
- `attributes-plist` A plist, or :default.

**Values**

- `result` A plist.

**Description**

The function `set-rich-text-pane-paragraph-format` sets paragraph attributes for the current paragraphs in `pane`. The current paragraphs are those paragraphs which overlap the current selection, or the paragraph containing the insertion point if there is no selection.

If `attributes-plist` is the symbol :default then the default paragraph format of the `pane` is used. Otherwise `attributes-plist` is a plist of keywords and values. These are the valid keywords on Microsoft Windows and Cocoa:

- `:alignment` :left, :right or :center.
- `:start-indent` A number setting the indentation.
- `:offset-indent` A number modifying the indentation.
- `:offset` A number setting the relative indentation of subsequent lines in a paragraph.
- `:right-indent` A number setting the right margin.
- `:tab-stops` A list of numbers.

Additionally this `attributes-list` keyword is valid on Microsoft Windows, only:

`numbering` specifies the numbering style. Rich Edit 3.0 supports all the above values of `numbering`. Please note that the Arabic and Roman styles start numbering from zero, and that only `t` and `:bullet` work with versions of Rich Edit before 3.0 (other values of `numbering` are quietly ignored).

`start-indent` specifies the indentation of the first line of a paragraph. A negative value removes the indentation.

`offset-indent` takes effect only when `start-indent` is not passed. It specifies an increase in the current indentation. Therefore, a negative value of `offset-indent` decreases the indentation.

`offset` specifies the offset of the second and following lines relative to the first line of the paragraph. That is, when the indentation of the first line is `indent`, the indentation of the second and subsequent lines is `indent + offset`. When `offset` is negative, the second and subsequent lines are indented less than the first line. If `indent + offset` is negative, then these lines are not indented.

`tab-stops` should be a list of numbers specifying the locations of tabs. No more than 32 tabs are allowed.

Example

```lisp
(setq rtp
  (capi:contain
    (make-instance
      'capi:rich-text-pane
        :visible-min-height 300
        :visible-min-width 400
        :paragraph-format
          '(::start-indent 20 :offset -15)
        :text (format nil "First paragraph.~%Second paragraph, a little longer.~%Another paragraph, which should be long long enough that it spans more than one line. ~"))
    )))

(capi:set-rich-text-pane-paragraph-format
  rtp '(:offset-indent 30 :numbering :lowercase))
```
See also  
rich-text-pane

rich-text-pane-paragraph-format

set-selection  

Function

Summary  
Sets the primary selection.

Package  
capi

Signature  
set-selection self value &optional string plist => result

Arguments  
self  
A displayed CAPI pane or interface.

value  
A Lisp object (not necessarily a string) to make available within the local Lisp image.

string  
The string representation of value to export, or nil. If nil and value is a string, then that will be exported as the string.

plist  
A property list of additional format/value pairs to export. The currently supported formats are :string, whose value should be a string, and :image whose value should be a image object. This allows you to export more than one format simultaneously.

Values  
result  
A string, or nil.

Description  
The function set-selection sets the primary selection to be the text of string.

On Microsoft Windows there is no notion of selection, so this mechanism is internal to Lisp.

Note that X applications may or may not use the primary selection for their paste operations. The most likely explanation for apparent inconsistencies after set-selection.
tion is that the pasting application does not use the primary selection. For instance, Emacs is configurable by the variable interprogram-paste-function.

See also
- `selection`
- `set-clipboard`
- “Clipboard” on page 265

**set-text-input-pane-selection**

**Generic Function**

Summary
Sets the selection in a `text-input-pane`.

Package
`capi`

Signature
`set-text-input-pane-selection pane start end`

Arguments
- `pane` A `text-input-pane`.
- `start, end` Bounding indexes for a subsequence of the text of `pane`.

Description
The function `set-text-input-pane-selection` sets the selection in `pane` to be the text bounded by the indexes `start` (inclusive) and `end` (exclusive).

See also
- `text-input-pane-selection`
- `text-input-pane`

**set-top-level-interface-geometry**

**Generic Function**

Summary
Sets the geometry of a top level interface.

Package
`capi`

Signature
`set-top-level-interface-geometry interface &key x y width height`
Arguments

interface A CAPI interface.

x, y, width, height

Integers specifying the new geometry.

Description

The coordinates of interface are modified according to the keyword arguments passed. The value of interface should be a top level interface. If a keyword is omitted then that part of the coordinates is not changed.

x and y are measured from the top-left of the screen rectangle representing the area of the primary monitor (the primary screen rectangle).

Notes

On Cocoa set-top-level-interface-geometry behaves as if an interface toolbar is not present, even if interface does contain an interface toolbar.

Example

(setf ii
  (capi:element-interface
     (capi:contain
       (make-instance 'capi:text-input-pane))))

(multiple-value-bind (x y width height)
    (capi:top-level-interface-geometry ii)
    (capi:execute-with-interface
      ii
      'capi:set-top-level-interface-geometry
      ii
      :x (round (+ x (/ width 4)))
      :y y
      :width (round (* 0.75 width))
      :height height))

See also

top-level-interface-p
top-level-interface-geometry
top-level-interface-display-state
interface
Chapter 7, “Programming with CAPI Windows”
set-vertical-scroll-parameters

Generic Function

Summary
Allows programmatic control of the parameters of a vertical scroll bar.

Package
capi

Signature
set-vertical-scroll-parameters self &key min-range max-range slug-position slug-size page-size step-size

Description
The function set-vertical-scroll-parameters sets the specified parameters of the vertical scroll bar of self, which should be a displayed instance of a subclass of output-pane (such as editor-pane) or layout.

The other arguments are:

- **min-range**: The minimum data coordinate.
- **max-range**: The maximum data coordinate.
- **slug-position**: The current scroll position.
- **slug-size**: The length of the scroll bar slug.
- **page-size**: The scroll page size.
- **step-size**: The scroll step size.

When one of these keyword arguments is not supplied, the value of the corresponding scroll parameter in self is not modified.

See “Scroll values and initialization keywords” on page 100 for a description of these scroll parameters.

Compatibility note
The function set-vertical-scroll-parameters supersedes the function set-scroll-range, which is deprecated and no longer exported.

The call
(set-vertical-scroll-parameters pane  
:min-range 0  
:max-range 42)

is equivalent to

(set-scroll-range pane nil 42)

Example

(example-edit-file "capi/output-panes/scroll-test")
(example-edit-file "capi/output-panes/scrolling-without-bar")
(example-edit-file "capi/output-panes/pane-can-scroll")

See also

get-vertical-scroll-parameters  
scroll  
set-horizontal-scroll-parameters  
simple-pane  
Chapter 7, “Programming with CAPI Windows”  
“output-pane scrolling” on page 199

shell-pane

Class

Summary A pane allowing the user to interact with a subprocess.

Package capi

Superclasses interactive-pane

Initargs :command The command which is run as a subprocess.

Accessors shell-pane-command

Description The class shell-pane creates an editor in which a subprocess runs.
User input is interpreted as input to the subprocess. In particular, when the user enters `Return` in the last line, the line is sent to the subprocess. The output of the subprocess is displayed in the pane.

The default value of `command` is `nil`, which means that the actual command is determined as follows:

On Unix/Linux/AIX and Mac OS X, the value of the environment variable `ESHELL` is used if set, and otherwise the environment variable `SHELL` is consulted. If that is not set, then `/bin/csh` (/bin/sh on SVR4 platforms) is run.

On Microsoft Windows 98/ME, `command` is run. On Windows XP/Vista/Windows 7/Windows 8, `cmd` is run. Please note that LispWorks 7.0 does not support Windows 98/ME/XP.

Example

This function emulates user input on `pane`:

```lisp
(defun send-keys-to-pane-aux (pane string newline-p)
  (loop for char across string
        do (capi:call-editor pane char))
  (if newline-p
      (capi:call-editor pane #\Return)))
```

This function trampolines to `send-keys-to-pane-aux` on the right process:

```lisp
(defun send-keys-to-pane (pane string newline-p)
  (capi:apply-in-pane-process pane
   'send-keys-to-pane-aux
   pane string newline-p))
```

```lisp
(setq sp (capi:contain
           (make-instance 'capi:shell-pane
                           :visible-min-width
                           '(character 60)
                           :visible-min-height
                           '(character 30))))
```

This call emulates the user typing `dir` followed by `Return`:

```lisp
(send-keys-to-pane sp "dir" t)
```
**show-interface**  
*Function*

**Summary**  
Brings the interface containing a specified pane onto the screen.

**Package**  
capi

**Signature**  
`show-interface pane`

**Description**  
The function `show-interface` brings the interface containing `pane` back onto the screen.

To hide the interface use `hide-interface`.

**See also**  
`hide-interface`  
`activate-pane`  
`interface`  
“Manipulating top-level windows” on page 105

**show-pane**  
*Function*

**Summary**  
Restores the specified pane to the screen.

**Package**  
capi

**Signature**  
`show-pane pane => pane`

**Arguments**  
`pane`  
An instance of `simple-pane` or a subclass.

**Description**  
The function `show-pane` restores the pane `pane` to the screen if it is hidden (for instance by `hide-pane`) or iconified.

**See also**  
`hide-pane`  
`show-interface`
**simple-layout**

*Class*

**Summary**

A *simple-layout* is a layout with a single child, and the child is resized to fill the space (where possible).

**Package**

`capi`

**Superclasses**

`x-y-adjustable-layout`

**Subclasses**

`switchable-layout`

**Description**

A simple layout’s description can be either a single child, or a list containing just one child. The simple layout then adopts the size constraints of its child, and lays the child out inside itself.

**Example**

```lisp
(capi:contain (make-instance 'capi:simple-layout :description (list (make-instance 'capi:text-input-pane))))
```

**See also**

`layout`

`row-layout`

`column-layout`

---

**simple-network-pane**

*Class*

**Summary**

A graph pane which arranges its nodes in a grid.

**Package**

`capi`

**Superclasses**

`graph-pane`

**Initargs**

`:x-gap` The horizontal node spacing.

`:y-gap` The vertical node spacing.
**Description**
The class `simple-network-pane` provides a graph which lays out its nodes in a rectangular grid by a simple algorithm.

The default values of \textit{x-gap} and \textit{y-gap} are 200 and 100 respectively.

\textit{simple-network-pane} is a subclass of \textit{choice}, so for details of its selection handling, see \textit{choice}.

**Example**
\begin{verbatim}
(example-edit-file "capi/graphics/network")
\end{verbatim}

**simple-pane**

**Summary**
The class `simple-pane` is the superclass for any elements that actually appear as a native window, and is itself an empty window.

**Package**
capi

**Superclasses**
element

**Subclasses**
display-pane
  interface
title-pane
  button-panel
  list-panel
  option-pane
  output-pane
  progress-bar
  slider
  text-input-pane
  tree-view
  toolbar
  layout
  button

**Initargs**

\begin{itemize}
  \item [:enabled] A boolean controlling whether the pane is enabled.
  \item [:background] The background color of the pane.
\end{itemize}
:**foreground**  The foreground color of the pane.

:**font**  The default font for the pane.

:**horizontal-scroll**  
\texttt{t, :without-bar, or nil}. If true the pane can scroll horizontally.

:**vertical-scroll**  
\texttt{t, :without-bar, or nil}. If true the pane can scroll vertically.

:**visible-border**  
A boolean or a keyword controlling whether the pane has a border, for some pane classes.

:**internal-border**  
A non-negative integer, or \texttt{nil}. Controls the width of the internal border.

:**cursor**  
A keyword naming a built-in cursor, or a cursor object, or \texttt{nil}.

:**pane-menu**  Specifies a menu to be raised by the \texttt{:post-menu} gesture.

:**drop-callback**  
Specifies a drop callback for \texttt{output-pane}, \texttt{interface}, \texttt{list-panel} or \texttt{tree-view}.

Note that this is now supported for \texttt{list-panel} and \texttt{tree-view} on Cocoa and GTK+.

:**drag-callback**  
Specifies a drag callback for \texttt{list-panel} or \texttt{tree-view}.

:**automatic-resize**  
A plist.
:scroll-if-not-visible-p
Defines whether, when the focus is given to the pane and the pane is not fully visible, the pane’s parent is automatically scrolled to show it.

:toolbar-title
A string.

The following initargs specify scroll parameters. These are actually useful only for output-pane and subclasses and for layouts. See entry for set-horizontal-scroll-parameters:

:scroll-horizontal-slug-size
:scroll-vertical-slug-size
:scroll-start-x
:scroll-start-y
:scroll-width
:scroll-height
:scroll-initial-x
:scroll-initial-y
:scroll-horizontal-step-size
:scroll-vertical-step-size
:scroll-horizontal-page-size
:scroll-vertical-page-size

Accessors
simple-pane-enabled
simple-pane-background
simple-pane-foreground
simple-pane-font
simple-pane-cursor
simple-pane-scroll-callback
simple-pane-drop-callback
simple-pane-drag-callback

Readers
simple-pane-horizontal-scroll
simple-pane-vertical-scroll
simple-pane-visible-border
Description

enabled determines whether the pane is enabled. The default value is t. Note that changing the enabled state of a visible pane by (setf simple-pane-enabled) changes its appearance.

background and foreground are colors specified using the Graphics Ports color system. Additionally on Cocoa, the special value :transparent is supported, which makes the pane’s background match that of its parent.

font should be a font, a font-description, a font alias, or nil. If it is not a font, it is converted to a font when the pane is created. nil is converted to the default font, and a font-description is converted as if by calling find-best-font.

pane-menu can be used to specify or create a menu to be displayed when the :post-menu gesture is received by the pane. It has the default value :default which means that make-pane-popup-menu is called to create the menu. For a full description of pane-menu, see “Popup menus for panes” on page 122.

Notes

1. foreground is ignored for buttons on Windows and Cocoa.
2. On Microsoft Windows pane-menu is not supported for title-pane. See title-pane for alternative approaches.

Description:

Cursor

cursor specifies a cursor for the pane. On Cocoa and GTK+, the cursor initarg has an effect only in output-pane and its subclasses. On other platforms it changes the cursor for other CAPI pane classes, although this may contravene style guidelines.

nil means use the default cursor, and this is the default value. cursor can also be a cursor object as returned by load-cursor. The other allowed values are keywords naming built-in cursors which are supported on each platform as shown in the table below.
<table>
<thead>
<tr>
<th>cursor</th>
<th>Cocoa</th>
<th>Windows</th>
<th>Motif</th>
</tr>
</thead>
<tbody>
<tr>
<td>:busy</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:i-beam</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:top-left-arrow</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:h-double-arrow</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:v-double-arrow</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:left-side</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:right-side</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:top-side</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:bottom-side</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:wait</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:crosshair</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:gc-notification</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:top-left-corner</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:top-right-corner</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:bottom-left-corner</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:bottom-right-corner</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:hand</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:fleur</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:move</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>:closed-hand</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>:open-hand</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>:disappearing-item</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 21.2
Description: Drag and drop

*drop-callback* can be specified for a pane that is an instance of
*output-pane, interface, list-panel, tree-view* or a subclass of one of these. When the user drags an object over a
window, the CAPI first tries to call the *drop-callback* of any
pane under the mouse and otherwise calls the *drop-callback* of
the top-level interface. The default value of *drop-callback* is
NIL, which means that there is no support for dropping into
the pane.

For *editor-pane*, *drop-callback* can be :default, which pro-
vides support for dropping a string into the pane and inserting
the string into the pane's editor buffer.

If *drop-callback* is any other non-NIL value, it should be either a
list (for simple cases) or function designator (to use all
options). When it is a function designator, it needs to have
this signature:

```
drop-callback pane drop-object stage
```

The function *drop-callback* is called by the CAPI at various
times such as when the pane is displayed and when the user
attempts to drop data into the pane. *pane* is the pane itself,
*drop-object* is an object used to communicate information
about the current dropping operation (see below) and *stage* is
a keyword. *drop-callback* should handle these values of *stage*:

- **:formats**
  This might occur when the pane is being dis-
  played or might occur each time the user
drags or drops an object over the pane. It
should call set-drop-object-supported-
formats with the *drop-object* and a list of for-
mats that the pane wants to receive. Each
format is a keyword. The list of the formats
must be the same each time it is called.

- **:enter**
  This occurs when the user drags an object
into a pane which is an *output-pane* or
*interface* (but not for a pane which is a
*list-panel* or *tree-view*). It can query the
drop-object using drop-object-provides-format and drop-object-allowed-drop-effect-p to discover what the user is dragging. It can also use drop-object-pane-x and drop-object-pane-y to query the mouse position relative to the pane. It should call (setf drop-object-drop-effect) with an effect if it wants to allow the object to be dropped. If this is not called, then the object cannot be dropped into the pane.

:leave
This occurs when the user drags an object out of a pane which is an output-pane or interface (but not for a pane which is a list-panel or tree-view).

:drag
This occurs while the user is dragging an object over the pane. It can query the drop-object using drop-object-provides-format and drop-object-allowed-drop-effect-p to discover what the user is dragging. For output-pane, it can use drop-object-pane-x and drop-object-pane-y to query the mouse position relative to the pane. For list-panel and tree-view, it can use drop-object-collection-index or drop-object-collection-item to query where the user is attempting to drop the object and can call their setf functions to adjust this position. It should call (setf drop-object-drop-effect) with an effect if it wants to allow the object to be dropped. If this is not called, then the object cannot be dropped into the pane. For output-pane and interface, it might also want to update the pane to indicate where the object will be dropped.
This occurs when the user drops an object over the pane. It can query the \texttt{drop-object} as for the \texttt{drag} stage, but can also obtain the object itself using \texttt{drop-object-get-object} for one of the formats in the list returned by \texttt{drop-object-provides-format}. Once the object is received, it should call \texttt{(setf drop-object-drop-effect)} with the effect that has been used by the callback. It should also update the pane to incorporate the object in whatever way the application requires.

When \texttt{drop-callback} is a list, it specifies a simple response. The list should be of the form:

\texttt{(effects formats drop-stage-callback \&optional checker)}

Both \texttt{effects} and \texttt{formats} can be either a list of effects or formats, or an atom which is interpreted as a list of one element. \texttt{effects} and \texttt{formats} specify which effects and formats are allowed.

For the stages except :\texttt{formats}, the first effect of the given effects that the \texttt{drop-object} allows is set (by calling \texttt{(setf drop-object-drop-effect)}), except when \texttt{checker} is supplied. In the latter case, before setting an effect it loops through the formats and calls the checker with three arguments:

\texttt{funcall checker pane effect format}

If \texttt{checker} returns non-nil it sets the effect. If \texttt{checker} returns \texttt{nil} for the formats, it goes to the next effect.

In the :\texttt{drop} stage, after setting the effect, it gets the object with first format that is provided by the \texttt{drop-object}, and then calls the \texttt{drop-stage-callback} with four arguments:

\texttt{funcall drop-stage-callback pane object x-or-index y-or-placement}
If the pane is a tree-view or list-panel, the last two arguments are the item index (for get-collection-item) and placement (:above, :item, :below), which are the results of drop-object-collection-index. Otherwise, the last two arguments are the x and y (results of drop-object-pane-x and drop-object-pane-y). It is the responsibility of the drop-stage-callback to perform whatever dropping should mean.

drag-callback can be specified for a pane that is an instance of list-panel or tree-view. The default value of drag-callback is nil, which means that there is no support for dragging from the pane. Otherwise, it should be a function designator with this signature:

drag-callback pane info => result

When the user drags items in the pane, the CAPI calls the drag-callback. pane is the pane itself and info is a list of item indices that are being dragged (compare with choice-selection).

The drag-callback should normally return a plist result whose keys are the data formats to be dragged, with a value associated with each format. Formats are arbitrary keywords that must be interpreted by the pane where you intend to drop the values (see the drop-callback). The format :string is understood by some other panes that expect text.

The plist result returned by drag-callback can contain the key :image-function with a function image-function as value.

This function is used to generate the image that is used in the dragging itself, exactly as the image-function in drag-pane-object is used. On Cocoa, tree-view and list-panel ignore this key in result.
**drag-callback** can also be used in top-level interfaces. In this case the second argument *info* is a flag describing the gesture that caused the call. Currently the only value is *:drag-image*, which means it was invoked by dragging the *drag-image* (see *interface*).

*drag-callback* is allowed to return the result *:default* rather than a plist. *:default* tells the system to do default dragging if there is any. At the time of writing the only place where there is default dragging is on Cocoa for an interface with an *:interfacepathname*. *drag-callback* is allowed to return the result *nil*, meaning do not do dragging.

On *output-pane* you add dragging by adding an entry to the *input-model* and which initiates the dragging by calling *drag-pane-object*.

**Notes: Drag and drop**

If *:image* is supplied in the plist returned by *drag-callback*, the dragging mechanism automatically frees the *image* object as if by *free-image* when it no longer needs it.

**Description: Scroll**

Any simple pane can be made scrollable by specifying *t* to *:horizontal-scroll* or *:vertical-scroll*. By default these values are *nil*, but some subclasses of *simple-pane* default them to *t* where appropriate (for instance *editor-panes* always default to having a vertical scroll-bar).

For a pane which is scrollable but does not display a scroll bar, pass the value *:without-bar* for *:horizontal-scroll* or *:vertical-scroll*. See the example in *output-panes/scrolling-without-bar.lisp*.

The height and width of a scrollable simple pane can be specified by the initargs *:scroll-height* and *:scroll-width*, which have the same meaning as *:internal-min-height* and *:internal-min-width*. See “Constraint Formats” on page 85 for more information about height and width initargs.
scroll-if-not-visible-p controls scrolling behavior of the parent when the pane is given the input focus. scroll-if-not-visible-p can be t, nil, or :non-mouse. See scroll-if-not-visible-p for details. When this initarg is supplied, the generic function (setf scroll-if-not-visible-p) is called with it.

**Description:**

**Border**

The value for visible-border can be any of the following, with the stated meanings where applicable:

- **nil** Has no border.
- **t** Has a border.
- **:default** Use the default for the window type.
- **:outline** Add an outline border.

There are various platform/pane class combinations which do not respond to all values of visible-border. For instance, on Windows XP with the default theme, text-input-choice and option-pane always have a visible border regardless of the value of visible-border, while other classes including display-pane, text-input-pane, list-panel, editor-pane and graph-pane have three distinct border styles, with visible-border :default meaning the same as visible-border t.

If internal-border is non-nil, it should be a non-negative integer specifying the width of an empty region around the edge of the pane.

**Description:**

**Miscellaneous**

automatic-resize makes the pane resize automatically. This has an effect only if it is placed inside a static-layout (including subclasses like pinboard-layout). The effect is that when the static-layout is resized then the pane also changes its geometry.

The value of automatic-resize defines how the pane’s geometry changes. It must be a plist of keywords and values which match the keywords of the function set-object-automatic-resize and are interpreted in the same way.
If the pane is used in the `toolbar-items` list of an `interface`, then `toolbar-title` should be a short string that will be shown near to the pane if required for the toolbar.

**Notes: Miscellaneous**

1. In order to display a simple pane, it needs to be contained within an interface. In a real application you will define your interface class, but for debugging and just playing around with pane the two convenience functions `make-container` and `contain` are provided to create an interface with enough support for that pane. The function `make-container` just returns a container for an element, and the function `contain` displays an interface created for the pane using `make-container`.

2. You can also control automatic resizing of a `simple-pane` using `set-object-automatic-resize`.

**Example**

```lisp
(capi:contain (make-instance 'capi:output-pane
  :background :red
  :scroll-width 300
  :horizontal-scroll t))

(setf ep
  (capi:contain
    (make-instance 'capi:editor-pane
      :visible-border t)))

(setf (capi:simple-pane-cursor ep) :crosshair)
```

For an example illustrating the use of `drag-callback`, see:

```lisp
(example-edit-file "capi/choice/drag-and-drop")
```

**See also**

- `contain`
- `define-font-alias`
- `set-object-automatic-resize`
- Chapter 3, “General Properties of CAPI Panes”
- Chapter 6, “Laying Out CAPI Panes”
- Chapter 9, “Adding Toolbars”
- “Transparency and the alpha channel” on page 222
**simple-pane-handle**

*Function*

**Summary**
Returns the window handle of a pane.

**Package**
capi

**Signature**
```
simple-pane-handle pane => handle
```

**Values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>An integer, or nil.</td>
</tr>
</tbody>
</table>

**Description**
The function `simple-pane-handle` returns the handle of `pane` in the system that displays it, if there is an underlying window.

On Microsoft Windows `handle` is the hwnd of `pane`.

On X11/Motif, `handle` is the windowid of the main part of `pane` (type Window in the X library).

If `pane` is not displayed, or if `pane` does not have an underlying window, then `handle` is nil. Note that layouts do not always have an underlying window.

Use this function with caution: in general, drawing and moving of CAPI windows should be done through the CAPI.

See also
- `current-dialog-handle`
- "Handles" on page 265

**simple-pane-visible-height**

*Generic Function*

**Summary**
Gets the visible height of a pane.

**Package**
capi

**Signature**
```
simple-pane-visible-height pane => result
```

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pane</td>
<td>A simple pane.</td>
</tr>
</tbody>
</table>
Values

| result | The height of the visible part of pane, or nil. |

Description

The generic function `simple-pane-visible-height` returns the height in pixels of the visible part of pane, that is the height of the viewport, not including any borders or scroll bars. If pane is not displayed the function returns `nil`.

See “Width and height hints” on page 80 for a description of the visible size of a pane.

See also

- `simple-pane-visible-size`
- `simple-pane-visible-width`
- `with-geometry`
- “Accessing pane geometry” on page 28

**simple-pane-visible-size**  
*Generic Function*

Summary

Gets the visible size of a pane.

Package

capi

Signature

`simple-pane-visible-size pane => width, height`

Arguments

| pane | A simple pane. |

Values

| width | The width of the visible part of pane, or nil. |
| height | The height of the visible part of pane, or nil. |

Description

The generic function `simple-pane-visible-size` returns the size in pixels of the visible part of pane, that is the width and height of the viewport, not including any borders or scroll bars. If pane is not displayed the return values are `nil`.

See “Width and height hints” on page 80 for a description of the visible size of a pane.
See also  
- `simple-pane-visible-height`
- `simple-pane-visible-width`
- `with-geometry`
  “Accessing pane geometry” on page 28

### simple-pane-visible-width

**Generic Function**

**Summary**

Gets the visible width of a pane.

**Package**

capi

**Signature**

```
simple-pane-visible-width pane => result
```

**Arguments**

- `pane`  
  A simple pane.

**Values**

- `result`  
  The width of the visible part of `pane`, or `nil`.

**Description**

The generic function `simple-pane-visible-width` returns the width in pixels of the visible part of `pane`, that is the width of the viewport, not including any borders or scroll bars. If `pane` is not displayed the function returns `nil`.

See “Width and height hints” on page 80 for a description of the visible size of a pane.

See also  
- `simple-pane-visible-height`
- `simple-pane-visible-size`
- `with-geometry`
  “Accessing pane geometry” on page 28

### simple-pinboard-layout

**Class**

**Summary**

A `simple-pinboard-layout` is a `pinboard-layout` that can contain just one pinboard object or pane as its child, and it adopts the size constraints of that child.
Package: capi

Superclasses: pinboard-layout
  simple-layout

Subclasses: graph-pane


Description: The class simple-pinboard-layout is normally used to place pinboard objects in a layout by placing the layout inside a simple-pinboard-layout, thus displaying the pinboard objects. It inherits all of its layout behavior from simple-layout.

Example: (setq column
  (make-instance 'capi:column-layout
    :description (list
      (make-instance 'capi:image-pinboard-object
        :image (example-file "capi/graphics/Setup.bmp"))
      (make-instance 'capi:item-pinboard-object
        :text "LispWorks"))
    :x-adjust :center))

  (capi:contain (make-instance 'capi:simple-pinboard-layout
    :child column))

See also: pinboard-object

simple-print-port Function

Summary: Prints the contents of an output pane to a printer.

Package: capi
The function `simple-print-port` prints the output pane specified by `port` to the default printer, unless specified otherwise by `printer`. The arguments of `scale` and `dpi` are used to determine how to transform the output pane’s coordinate space to physical units. Their meaning here is the same as in `get-page-area`, except that `scale` may also take the value `:scale-to-fit`, in which case the pane is printed as large as possible on a single sheet.

The background color of `port` is ignored, and the value given by the argument `background` is used instead. This defaults to `:white`.

drawing-mode should be either `:compatible` which causes drawing to be the same as in LispWorks 6.0, or `:quality` which causes all the drawing to be transformed properly, and allows control over anti-aliasing on Microsoft Windows and GTK+. The default value of `drawing-mode` is `:quality`.

For more information about `drawing-mode`, see “The drawing mode and anti-aliasing” on page 209.

If `interactive` is `t`, a print dialog is displayed. This is the default. If `interactive` is `nil`, then the document is printed to the current printer without prompting the user.

Examples

```
(exexample-edit-file "capi/printing/simple-print-port")
(exexample-edit-file "capi/printing/multi-page")
```

See also

`print-dialog`

Chapter 13, “Drawing - Graphics Ports”

“Printing from the CAPI—the Hardcopy API” on page 249
**slider**

**Summary**  
A pane with a sliding marker, which allows the user to control a numerical value within a specified range.

**Package**  
capi

**Superclasses**  
range-pane  
titled-object  
simple-pane

**Initargs**  
:print-function  
A function of two arguments, or a format string.

:show-value-p  
A generalized boolean.

:start-point  
A keyword.

:tick-frequency  
An integer, a ratio or the keyword :default.

**Accessors**  
slider-print-function

**Readers**  
slider-show-value-p  
slider-start-point  
slider-tick-frequency

**Description**  
The class slider allows the user to enter a number by moving a marker on a sliding scale to the desired value.

show-value-p determines whether the slider displays the current value, on Microsoft Windows and GTK+. The default value is t. show-value-p is ignored on Cocoa.

start-point specifies which end of the slider is the start point in the range. The values allowed depend on the orientation of the slider. For horizontal sliders, start-point can take these values:

:left  
The start point is on the left.
The start point is on the right.

The start point is at the default side (the left).

For vertical sliders, start-point can take these values:

The start point is at the top.

The start point is at the bottom.

The start point is at the default position, which is the top on Microsoft Windows and Motif, and the bottom on Cocoa.

tick-frequency specifies the spacing of tick marks drawn on the slider. If tick-frequency is :default, then the slider may or may not draw tick marks according the OS conventions. If tick-frequency is 0, then no tick marks are drawn. If tick-frequency is a ratio 1/N for integer N>1, then tick marks are drawn to divide the slider range into N sections. Otherwise tick-frequency should be an integer greater than 1 which specifies the spacing of tick marks in units between start and end. The default value of tick-frequency is :default.

print-function, when supplied, should be a function with signature

print-function pane value => result

where pane is the slider pane, value is its current value, and result is a string or nil. When the slider pane displays the current value, it calls print-function and displays the value as result, unless that is nil, in which case the value is printed normally.

As a special case, print-function can also be a string, which is used as the format string in a call to format with one additional argument, the value, that is

(format nil print-function value)

and the result of this call to format is displayed.

Notes

1. :print-function is not implemented on Motif.
2. \texttt{:print-function} has no effect on Cocoa because the slider pane never displays the value.

3. Use of the \textit{print-function} is determined when the slider pane is displayed. Setting the \textit{print-function} in a slider that did not have a \textit{print-function} when it was first displayed does not work until the slider is destroyed and displayed again. Therefore, if you want to display a slider without a \textit{print-function} but set it later, initially you should supply a \textit{print-function} that always returns \texttt{nil}, for example:

   \begin{verbatim}
   (make-instance 'capi:slider
   :start 10 :end 34
   :print-function 'false)
   \end{verbatim}

4. \textit{print-function} is useful for displaying fractional values or values that grow logarithmically (or any other non-linear function), because the actual values in a slider are always integers that increase linearly as the slider moves.

5. On Windows the slider’s value is displayed (when \textit{show-value-p} is true) in a tooltip that is visible only while the user moves the marker with a mouse.

**Compatibility note**

In LispWorks 6.0 and earlier versions, ticks are drawn as if \textit{tick-frequency} is \texttt{:default}.

**Example**

Given the default \textit{start} and \textit{end} of 0 and 100, this gives ticks at 0, 25, 50, 75 and 100:

\begin{verbatim}
   (make-instance 'slider :tick-frequency 25)
\end{verbatim}

while this gives ticks at 0, 20, 40, 60, 80 and 100:

\begin{verbatim}
   (make-instance 'slider :tick-frequency 1/5)
\end{verbatim}

This example illustrates the use of \textit{print-function} to display fractional and non-linear values ranges:

\begin{verbatim}
   (example-edit-file "capi/elements/slider-print-function")
\end{verbatim}
See also “Slider, Progress bar and Scroll bar” on page 29

sort-object-items-by

Function

Summary Sorts items according to a sorted-object.

Package capi

Signature sort-object-items-by sorted-object items => result

Arguments

- sorted-object An instance of sorted-object or a sub-class.
- items A list.

Values

- result A permutation of items.

Description The function sort-object-items-by sorts items according to the current sort type of sorted-object, as set by sorted-object-sort-by.

Notes

1. If the sort type is reversed, items will be sorted in reverse order.
2. The sorting may be destructive, that is the items list may be modified during a call to sort-object-items-by.

See also

- sorted-object
- sorted-object-sort-by
- sorted-object-sorted-by

sorted-object

Class

Summary Defines sorting operations.
Package capi

Superclasses standard-object

Subclasses list-panel

Initargs :sort-descriptions
  A list.

Description The class sorted-object defines sorting operations.

sorted-object is an interface for sorting the items in list-panel and list-view.

Each element of sort-descriptions is a sorting description object, as returned by make-sorting-description. These define various sorting options and are used by sorted-object-sort-by and sort-object-items-by.

Notes The subclass multi-column-list-panel supports sortable columns.

See also list-panel
  list-view
  make-sorting-description
  sort-object-items-by
  sorted-object-sort-by
  sorted-object-sorted-by

sorted-object-sort-by
  Generic Function

Summary Sets the sorting type of a sorted-object.

Package capi

Signature sorted-object-sort-by pane new-sort-type &key allow-reverse
Arguments

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>pane</td>
<td>An instance of <code>sorted-object</code> or a subclass.</td>
<td></td>
</tr>
<tr>
<td>new-sort-type</td>
<td>The sort type to set.</td>
<td></td>
</tr>
<tr>
<td>allow-reverse</td>
<td>A boolean.</td>
<td></td>
</tr>
</tbody>
</table>

Description

The generic function `sorted-object-sort-by` sets the sort type of `pane` to `new-sort-type`. `new-sort-type` must match by `cl:equalp` the type of one of the sorting descriptions of `pane`.

If `allow-reverse` is non-nil and the sort type already matches `new-sort-type`, then the sort reverses the order of the `items`. The default value of `allow-reverse` is `t`.

If `pane` is a `list-panel`, then `sorted-object-sort-by` also calls `sort-object-items-by` to sort the items with the new sort type. For your own subclasses of `sorted-object` which are not subclasses of `list-panel`, if you need this behavior define an `:after` method that calls `sort-object-items-by`. You can also define `:after` methods on subclasses of `list-panel` to perform other tasks each time the items are sorted.

See also

- `list-panel`
- `sort-object-items-by`
- `sorted-object`
- `sorted-object-sorted-by`

`sorted-object-sorted-by` Function

Summary

Returns the current sorting type and reverse flag of a `sorted-object`.

Package

`capi`

Signature

`sorted-object-sorted-by pane => sort-type, reversed`
Arguments  
 pane  
 An instance of sorted-object or a subclass.

Values  
 sort-type  
 A sort type.
 reversed  
 A boolean.

Description  
The function sorted-object-sorted-by returns the current sorting type sort-type and reverse flag reversed of pane.

sort-type is the type of one of the sorting descriptions of pane. reversed is true if the pane is sorted in reverse order and false if it is sorted in normal order.

See also  
 sorted-object
 sorted-object-sort-by

start-drawing-with-cached-display  

Function

Summary  
Temporarily replaces an output pane’s display-callback such that it draws from the cached display and optionally adds further drawing.

Package  
capi

Signature  
start-drawing-with-cached-display pane temp-display-callback &key automatic-cancel user-info

Arguments  
 pane  
 An output-pane.
 temp-display-callback  
 A function designator, or nil.
 automatic-cancel  
 A generalized boolean.
 user-info  
 A Lisp object.
The function `start-drawing-with-cached-display` caches the display of the output pane `pane` (by calling `output-pane-cache-display`), remembers the current `display-callback`, and replaces the `display-callback` with a callback that first uses the cached display to redraw the area and then uses the `temp-display-callback` (if non-nil) to draw additional arbitrary drawing. `temp-display-callback` has the same signature as the `display-callback` of `pane`:

```
temp-display-callback pane x y width height
```

The arguments that will be passed to the `temp-display-callback` are determined by calls to `update-drawing-with-cached-display` or `update-drawing-with-cached-display-from-points`. These functions should be called whenever the temporary display needs to be updated.

The effect of `start-drawing-with-cached-display` is undone by any call to `output-pane-free-cached-display` (implicit or explicit). Since `output-pane-cache-display`, and hence `start-drawing-with-cached-display` itself, makes an implicit call to `output-pane-free-cached-display`, it is not essential to call `output-pane-free-cached-display` between calls. However, the cached display can be quite large, so it is normally better to call `output-pane-free-cached-display` as soon as the cache is no longer needed.

If `automatic-cancel` is true then the cached drawing is automatically cancelled (by an implicit call to `output-pane-free-cached-display`) when the pane loses the focus. This is useful when a cached display is used temporarily, for example during drag and drop. If the cached display needs to survive longer, pass `:automatic-cancel nil`. The default value of `automatic-cancel` is true.
user-info is an arbitrary value which will be returned by calls to output-pane-cached-display-user-info and the call to output-pane-free-cached-display. It is useful for keeping information during an operation that uses the cached display, for example drag and drop.

Notes

1. The most natural usage of this function is in the :press input model handler, with a matching output-pane-free-cached-display call in the :release handler, to temporarily draw something on top of the permanent display while the user drags the mouse.


Examples

This file shows how to use start-drawing-with-cached-display in the :press input model handler:

(example-edit-file "capi/output-panes/cached-display")

See also

output-pane-cache-display
output-pane-free-cached-display
output-pane-cached-display-user-info
redraw-drawing-with-cached-display
update-drawing-with-cached-display
update-drawing-with-cached-display-from-points
“Transient display on output-pane and subclasses” on page 202
**start-gc-monitor**

*Function*

**Summary**
Starts a Lisp Monitor window.

**Package**
capi

**Signature**

\[
\text{start-gc-monitor } \text{screen} \rightarrow \text{result}
\]

**Arguments**

\[
\text{screen} \quad \text{A screen.}
\]

**Values**

\[
\text{result} \quad \text{A boolean.}
\]

**Description**
The function **start-gc-monitor** starts a Lisp Monitor window (otherwise known as the GC or Garbage Collector monitor) on the screen `screen`.

`result` is `t` if it started a Lisp monitor, and `nil` if a Lisp monitor was already running on `screen`.

Note that this works only on Motif. There is no Lisp Monitor window on other platforms.

On Motif, **start-gc-monitor** is called automatically when the LispWorks IDE starts, but you can call **stop-gc-monitor** and **start-gc-monitor** any time.

**See also**

**stop-gc-monitor**

---

**static-layout**

*Class*

**Summary**
A layout that allows its children to be positioned anywhere within itself.

**Package**
capi

**Superclasses**
layout

**Subclasses**
pinboard-layout
Initargs :fit-size-to-children

A generalized boolean.

Description

The class static-layout is a layout that allows its children to be positioned anywhere within itself.

When a static-layout lays out its children, it positions them at the \(x\) and \(y\) specified as hints (using \(:x\) and \(:y\) ), and sizes them to their minimum size (which can be specified using \:visible-min-width and \:visible-max-width\).

If \textit{fit-size-to-children} is true, the static-layout is made sufficiently large to accommodate all of its children, and grows and modifies its scrollbars (if they exist) if necessary when a child is added. This is the default behavior. Otherwise the static layout has a minimum size of one pixel by one pixel which is not affected by the size of its children. If you need the sizing capabilities, then use the class simple-layout which surrounds a single child, and adopts the size constraints of that child.

Example

Here is an example of a static layout placing simple panes at arbitrary positions inside itself.

\[(\text{capi:contain}
\text{(make-instance}
\text{ 'capi:static-layout}
\text{ :description}
\text{ (list (make-instance}
\text{ 'capi:text-input-pane}
\text{ \ :x 20}
\text{ \ :y 100)
\text{ (make-instance}
\text{ 'capi:push-button-panel}
\text{ \ :x 30}
\text{ \ :y 200}
\text{ \ :items '(1 2 3)))}
\text{ :best-width 300 :best-height 300))}\]

There are further examples in Chapter 20, “Self-contained examples”.
See also  

**pinboard-layout**

---

**static-layout-child-geometry**

*Function*

**Summary**

Gets or sets the geometry of a child in a `static-layout`.

**Package**

`capi`

**Signature**

`static-layout-child-geometry pinboard-object-or-pane => x, y, width, height`

**Signature**

`setf (static-layout-child-geometry pinboard-object-or-pane)  
(values x y width height)`

**Arguments**

`pinboard-object-or-pane` A `pinboard-object` or a pane.

**Values**

`x, y, width, height` Integers.

**Description**

The function `static-layout-child-geometry` returns as multiple values the `x`, `y`, `width` and `height` of its argument. The setter can be used with all four values at the same time.

The setter can be used be used to set only some of the values, by using `t` for values that need not change. For example, changing the `x` coordinate to 100 and the `width` to 50 without affecting the vertical dimension:

```
(setf (static-layout-child-geometry pinboard-object)  
(values 100 t 50 t))
```

The values that `static-layout-child-geometry` gets or sets are the same as the values that `static-layout-child-position` and `static-layout-child-size` get and set. The setter is more efficient than using the setters of `static-layout-child-position` and `static-layout-child-size` sequentially, and does only one redisplay.
<table>
<thead>
<tr>
<th><strong>Summary</strong></th>
<th>Gets and sets the location of an object inside its parent <code>static-layout</code>.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Package</strong></td>
<td>capi</td>
</tr>
<tr>
<td><strong>Signature</strong></td>
<td><code>static-layout-child-position self =&gt; x, y</code></td>
</tr>
<tr>
<td></td>
<td><code>setf (static-layout-child-position self) (values x y) =&gt; x, y</code></td>
</tr>
<tr>
<td><strong>Arguments</strong></td>
<td><code>self</code></td>
</tr>
<tr>
<td><strong>Values</strong></td>
<td><code>x, y</code></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>The generic function <code>static-layout-child-position</code> returns as multiple values <code>x, y</code> the coordinates of <code>self</code> inside its parent <code>static-layout</code>. There is also a <code>setf</code> expansion which sets the location of <code>self</code> in its parent.</td>
</tr>
</tbody>
</table>
Example

(let* ((po (make-instance 'capi:item-pinboard-object
  :text "5x5" :x 5 :y 5
  :graphics-args
  '(:background :red)))
  (pl (capi:contain
        (make-instance 'capi:pinboard-layout
          :description (list po)
          :visible-min-width 200
          :visible-min-height 200))))
  (capi:execute-with-interface
   (capi:element-interface pl)
   #'(lambda (po)
       (dotimes (x 20)
         (mp:wait-processing-events 1)
         (let ((new-x (* (1+ x) 10)))
           (new-y (* 5 (+ 2 x))))
         (setf (capi:item-text po)
               (format nil "~a~a" new-x new-y))
         (setf (capi:static-layout-child-position po)
               (values new-x new-y)))))
   po))

See also
static-layout
static-layout-child-size

static-layout-child-size

Generic Function

Summary
Gets and sets the size of an object inside its parent static-layout.

Package
capi

Signature
static-layout-child-size self => width, height

setf (static-layout-child-size self) (values width height) => width, height

Description
The generic function static-layout-child-size returns as multiple values width, height the dimensions of self.

There is also a setf expansion which sets the dimensions of self.
Example

```lisp
(let* ((po (make-instance 'capi:pinboard-object
: x 5 : y 5
: width 5 : height 5
: graphics-args
'(:background : red)))
(pl (capi:contain
 (make-instance 'capi:pinboard-layout
 : description (list po)
 : visible-min-width 200
 : visible-min-height 200)))
(capi:execute-with-interface
 (capi:element-interface pl)
 '#(lambda (po)
 (dotimes (x 20)
 (mp:wait-processing-events 1)
 (let ((new-x (* (1+ x) 10)))
 (new-y (* 5 (+ 2 x))))
 (setf (capi:static-layout-child-size po)
 (values new-x new-y))))
po))
```

See also

- static-layout
- static-layout-child-position

**stop-gc-monitor**

*Function*

**Summary**

Stop a Lisp Monitor.

**Package**

capi

**Signature**

`stop-gc-monitor screen => result`

**Arguments**

- `screen`: A screen.

**Values**

- `result`: A boolean.

**Description**

The function `stop-gc-monitor` stops the Lisp Monitor window on the screen `screen`.

`result` is `t` if it stopped a Lisp monitor, and `nil` if there was no Lisp monitor running on `screen`. 
Note that this works only on Motif. The Lisp monitor can be restarted with \texttt{start-gc-monitor}.

See also \texttt{start-gc-monitor}

\textbf{stop-sound} \quad \textit{Function}

\textbf{Summary} \quad \texttt{stop-sound} stops a sound from playing.

\textbf{Signature} \quad \texttt{stop-sound} \ \textit{sound}

\textbf{Arguments} \quad \textit{sound} \quad \text{A sound object returned by \texttt{load-sound}}.

\textbf{Description} \quad The function \texttt{stop-sound} stops the sound \textit{sound} from playing.

See also \texttt{play-sound}  
“Sounds” on page 264

\textbf{switchable-layout} \quad \textit{Class}

\textbf{Summary} \quad A layout which displays only one of its children at a time, and supports switching to another child.

\textbf{Package} \quad \texttt{capi}

\textbf{Superclasses} \quad \texttt{simple-layout}

\textbf{Initargs} \quad

\begin{itemize}
  \item \texttt{:visible-child} \quad \text{The currently visible pane from the children.}
  \item \texttt{:combine-child-constraints} \quad \text{A generalized boolean.}
\end{itemize}
The class `switchable-layout` is a subclass of `simple-layout` which displays only one of its children at a time, and provides functionality for switching the displayed child to one of the other children.

The layout’s description contains a list of its children. The argument `visible-child` specifies the initially visible child (which defaults to the first of the children).

`switchable-layout` inherits most of its layout behavior from `simple-layout` as it only ever lays out one child at a time.

`combine-child-constraints` influences the initial size of the layout. When `combine-child-constraints` is `nil` the constraints of the switchable layout depend only on its currently visible child pane. Switching to a different child pane might cause the layout to resize. When `combine-child-constraints` is non-nil, the constraints depend on all of the child panes, including those that are not visible. This might increase the time taken to create the switchable layout initially, but can prevent unexpected resizing later. The default value of `combine-child-constraints` is `nil`. 

Readers

`switchable-layout-visible-child`

`switchable-layout-combine-child-constraints`
Example

```lisp
(setq children (list
  (make-instance 'capi:push-button
    :text "Press Me")
  (make-instance 'capi:list-panel
    :items '(1 2 3 4 5))))

(setq layout (capi:contain
  (make-instance
    'capi:switchable-layout
    :description children)))

(capi:apply-in-pane-process
  layout #'(setf capi:switchable-layout-visible-child)
  (second children) layout)

(capi:apply-in-pane-process
  layout #'(setf capi:switchable-layout-visible-child)
  (first children) layout)

Here is a further example:

(example-edit-file "capi/layouts/switchable")
```

See also

simple-layout
switchable-layout-switchable-children
Chapter 6, “Laying Out CAPI Panes”
Chapter 7, “Programming with CAPI Windows”
“Changing a non-standard toolbar dynamically” on page 135

---

**switchable-layout-switchable-children**

*Generic Function*

**Summary**

Finds the switchable children of a `switchable-layout`.

**Package**

capi

**Signature**

`switchable-layout-switchable-children switchable-layout => result`

**Arguments**

`switchable-layout`

An instance of `switchable-layout` or a subclass.
Values

result  A list of panes.

Description

The generic function `switchable-layout-switchable-children` returns as a list all the children of `switchable-layout` that could be made visible by calling the `switchable-layout` accessor (`setf switchable-layout-visible-child`).

See also

`switchable-layout`

tab-layout

Class

Summary

A tab-layout displays multiple tabs and a pane which shows the main contents. The user can select a tab, which affects what is displayed in the pane.

Package  capi

Superclasses  choice layout

Initargs

:description  The main layout description.

:items  Specifies the tabs of the tab layout.

:visible-child-function  Returns the visible child for a given selection in switchable mode.

:combine-child-constraints  A generalized boolean which influences the initial size of the layout.

:print-function  The function used to print a name on each tab.
**:callback-type**: The type of data passed to the callback function in callback mode.

**:selection-callback**: The function called when a tab is selected, in callback mode.

**:image-function**: Returns an image for an item, on Microsoft Windows.

**:image-lists**: A plist of keywords and image-list objects, on Microsoft Windows.

---

**Accessors**

- tab-layout-visible-child-function

**Readers**

- tab-layout-combine-child-constraints
- tab-layout-image-function

**Description**

`tab-layout` is a subclass of `choice`. Most importantly it inherits `choice`'s selection and `selection-callback` behavior, and its `print-function` (which is used to determine the string that appear in each tab), and its `items` behavior (which in turn derives from `collection`).

`tab-layout` has two modes:

**Switchable mode**

Selecting a different tab causes a different pane to be displayed.

**Callback mode**

Selecting a tab merely calls a callback. This callback is responsible for make any required change.

The mode of a `tab-layout` is determined by the initarg `:visible-child-function`. A non-nil value specifies switchable mode, nil specifies callback mode.
In switchable mode, selecting on a tab causes a call to the function `visible-child-function` (after doing the `selection-call-back`) with the selected item as a single argument. `visible-child-function` must return a pane, which is then displayed. The pane that is returned by `visible-child-function` must not be displayed elsewhere, but can be any pane. Repeated calls with the same item should return the same pane, otherwise it will create a new pane each time the tab is selected.

In callback mode there is only one pane, which you must specify by the initarg `:description` (which is inherited from `layout`). In this case the `selection-callback` must perform any changes that are needed.

In either mode `combine-child-constraints` influences the initial size of the layout. When `combine-child-constraints` is `nil` the constraints of the tab layout depend only on its currently visible tab. Switching to a different tab might cause the layout to resize. When `combine-child-constraints` is non-nil, the constraints depend on all of the tabs, including those that are not visible. This might increase the time taken to create the tab layout initially, but can prevent unexpected resizing later. The default value of `combine-child-constraints` is `nil`.

If `image-lists` is specified, it should be a plist containing the keyword `:normal` as a key. The corresponding value should be an `image-list` object. No other keys are supported at the present time. The `image-list` associated with the `:normal` key is used with the `image-function` to specify an image to display in each tab.

The `image-function` is called on an item to return an image associated with the item. It can return one of the following:

A pathname or string

This specifies the filename of a file suitable for loading with `load-image`. Currently this must be a bitmap file.
A symbol  The symbol must have been previously registered by means of a call to \texttt{register-image-translation}.

An image object, as returned by \texttt{load-image}.

An image locator object

This allowing a single bitmap to be created which contains several button images side by side. See \texttt{make-image-locator} for more information. On Microsoft Windows, it also allows access to bitmaps stored as resources in a DLL.

An integer  This is a zero-based index into the tab-layout’s \texttt{image-list}. This is generally only useful if the image list is created explicitly. See \texttt{image-list} for more details.

Notes  \texttt{image-lists} and \texttt{image-function} are implemented only on Microsoft Windows.

Example  The following example shows the use of the switchable mode of \texttt{tab-layout}. Each tab is linked to an output pane by pairing them in the \texttt{items} list.

\begin{verbatim}
(defun switchable-tab-layout ()
  (let* ((red-pane (make-instance 'capi:output-pane
                                   :background :red))
         (blue-pane (make-instance 'capi:output-pane
                                   :background :blue))
         (tl (make-instance 'capi:tab-layout
                            :items
                            (list (list "Red" red-pane)
                                  (list "Blue" blue-pane))
                            :print-function 'car
                            :visible-child-function 'second)))
    (capi:contain tl)))

(switchable-tab-layout)
\end{verbatim}
Here is an example of the callback mode of **tab-layout**, which uses the selection of a tab to change the nodes of a graph pane through the **selection-callback**.

```lisp
(defun non-switchable-tab-layout (tabs)
  (let* ((gp (make-instance 'capi:graph-pane))
         (tl (make-instance 'capi:tab-layout
                           :description (list gp)
                           :items tabs
                           :visible-child-function nil
                           :print-function
                           (lambda (x)
                             (format nil "-R* x"))
                           :callback-type :data
                           :selection-callback
                           #'(lambda (data)
                               (setf (capi:graph-pane-roots gp)
                                     (list data))))))
    (capi:contain tl)))
  (non-switchable-tab-layout '(1 2 4 5 6))
)
```

See also

- callbacks
- simple-layout
- switchable-layout
- tab-layout-panes
- tab-layout-visible-child

“Tab layouts” on page 88
Chapter 7, “Programming with CAPI Windows”

---

**tab-layout-panes**

**Function**

**Summary**

Returns the panes in a **tab-layout**.

**Package**

capi

**Signature**

`tab-layout-panes tab-layout => panes`

**Arguments**

`tab-layout` A **tab-layout**.
Values  

panes  

A list.

Description  
The function **tab-layout-panes** returns the panes in a **tab-layout**. Note that this is not necessarily the same as the items of **tab-layout**, since **visible-child-function** and/or **key** may be specified.

See also  
**tab-layout**

“Tab layouts” on page 88

---

**tab-layout-visible-child**  

Function

Summary  
Returns the visible child in a **tab-layout**.

Package  
capi

Signature  

\textbf{tab-layout-visible-child} \hspace{1em} \textit{tab-layout} \Rightarrow \hspace{1em} \textit{result}

Arguments  

\textit{tab-layout} \hspace{1em} A **tab-layout**.

Values  

\textit{result} \hspace{1em} A pane.

Description  
The function **tab-layout-visible-child** returns the currently-visible pane in a **tab-layout**.

See also  
**tab-layout**

“Tab layouts” on page 88

---

**text-input-choice**  

Class

Summary  
This pane consists of a text input area, and a button. Clicking on the button displays a list of editable strings, and selecting one of the strings automatically pastes it into the text input area.
Package        capi
Superclasses   choice
text-input-pane
Initargs       :visible-items-count
                An integer specifying the maximum length of the list, or the symbol :default.
                :popup-callback
                A function called just before the list appears, or nil.

Description    The class text-input-choice behaves in the same way as a text-input-pane, but has additional functionality. The element inherits from choice, and the choice items are used as the items to display when the user clicks on the button. The callback is called when the user presses the Return key. The selection-callback is called when the user selects an item in the list.

Notes          The user can edit the items in a text-input-choice. For an element with similar functionality which does not allow editing, see option-pane.

Compatibility  note
               In LispWorks 6.0 and earlier versions the text-input-pane initarg value enabled :read-only is not supported for text-input-choice on Microsoft Windows. This restriction is removed for LispWorks 6.1 and later versions.

Examples       (example-edit-file "capi/elements/text-input-choice")

See also       choice
                option-pane
text-input-pane
Chapter 5, “Choices - panes with items”
“Toolbar items other than buttons with images” on page 133
The class `text-input-pane` is a pane for entering a single line of text.

**Package**
capi

**Superclasses**
titled-object
simple-pane

**Subclasses**
multi-line-text-input-pane
password-pane
text-input-choice

**Initargs**
- `:text` The text in the pane.
- `:caret-position` The position of the caret in the text (from 0).
- `:max-characters` The maximum number of characters allowed.
- `:enabled` Controls the enabled state of the pane.
- `:callback` A function usually called when the user presses Return.
- `:callback-type` The type of arguments to `callback`.
- `:change-callback` A function called when a change is made.
- `:change-callback-type` The type of arguments to `change-callback`.
- `:text-change-callback` A function designator.
:confirm-change-function
A function called to validate a change.
Note: Implemented for Motif only, not Microsoft Windows or Mac OS X.

:gesture-callbacks
A list of pairs (gesture . callback).

:completion-function
A function called to complete the text.

:in-place-completion-function
A function designator.

:file-completion
t, nil or a pathname designator.

:in-place-filter
A boolean.

:directories-only
A boolean.

:ignore-file-suffices
A list of strings or the keyword :default.

:complete-do-action
A boolean.

:navigation-callback
A function called when certain keyboard gestures occur in the pane.

:editing-callback
A function called when editing starts or stops.

:buttons
A plist specifying buttons to add, or t or nil.
Along with the next four initargs, this is implemented only on Cocoa. It specifies that the pane has "recent-items", which also means using NSSearchField.

:recent-items
See :search-field above.

:recent-items-name
See :search-field above.

:maximum-recent-items
See :search-field above.

:recent-items-mode
See :search-field above.

Accessors
text-input-pane-text
text-input-pane-max-characters
text-input-pane-enabled
text-input-pane-callback
text-input-pane-confirm-change-function
text-input-pane-change-callback
text-input-pane-completion-function
text-input-pane-navigation-callback
text-input-pane-editing-callback
text-input-pane-buttons-enabled

Readers
text-input-pane-caret-position

Description
The class text-input-pane provides a great deal of flexibility in its handling of the text being entered. It starts with the initial text and caret-position specified by the arguments text and caret-position respectively. It limits the number of characters entered with the max-characters argument (which defaults to nil, meaning there is no maximum).

If enabled is nil, the pane is disabled. If enabled is :read-only, then the pane shows the text and allows it to be selected without it being editable. In this case the visual appearance varies between window systems, but often the text can be
copied and the caret position altered. If enabled is any other true value, then the pane is fully enabled. The default value of enabled is t.

You can programmatically get and set the selection and caret position by set-text-input-pane-selection, text-input-pane-selected-text, text-input-pane-selection and text-input-pane-caret-position. You can programmatically perform standard edit operations by using text-input-pane-paste, text-input-pane-copy, text-input-pane-cut and text-input-pane-delete. You can programmatically invoke the completion functions by text-input-pane-complete-text and text-input-pane-in-place-complete.

For more than one line of input, use multi-line-text-input-pane.

Description:

Callbacks

callback, if non-nil, is called when the user presses Return, unless navigation-callback is non-nil, in which case navigation-callback is called instead. If the pane has "recent-items" (implemented only on Cocoa) then the timing of calls to callback is modified: see the discussion of recent-items below for the details.

When the text or caret-position is changed, the callback change-callback is called with the text, the pane itself, the interface and the caret-position. The arguments that are passed to the change-callback can be altered by specifying the change-callback-type (see the callbacks class for details of possible values).

With the Motif implementation it is possible to check changes that the user makes to the text-input-pane by providing a confirm-change-function which gets passed the new text, the pane itself, its interface and the new caret position, and which should return non-nil if it is OK to make the change. If nil is returned, then the pane will be unaltered and a beep will be signalled to indicate that the new values were invalid.
**gesture-callbacks** provides callbacks to perform for specific keyboard gestures. Each **gesture** must be an object that **sys:coerce-to-gesture-spec** can coerce to a gesture-spec. Each **callback** can be a callable (symbol or function) which takes one argument, the pane. Alternatively each **callback** can be a list of the form (function arguments). Note that in this case, the pane itself is not automatically passed to the function amongst arguments.

When the user enters a gesture that matches **gesture** in any pair amongst **gesture-callbacks**, the **callback** is executed and the gesture is not processed any more.

**text-change-callback** is a change callback (see **change-callback**) that is called only when the text in the pane changes. In contrast, **change-callback** is also called when the caret moves. If both **text-change-callback** and **change-callback** are supplied, only **text-change-callback** is invoked.

**Notes:**

1. **change-callback** is potentially called more than once for each user gesture.

2. The interaction of in-place completion is implemented using **gesture-callbacks**. Gestures which you define explicitly by **gesture-callbacks** override the gestures which are defined implicitly by the in-place completion mechanism.

3. For gestures that change the text, **text-change-callback** is probably better than **gesture-callbacks**.

**Description:**

A **completion-function** can be specified which will get called when the completion gesture is made by the user (by pressing the Tab key) or when **text-input-pane-complete-text** is called. The function should have signature:

```
completion-function pane string => completions, start, end
```
where pane is the text-input-pane itself and string is the string to complete. When completion is invoked completion-function is called with pane and a string containing the text of pane to the left of the cursor.

The completion-function is called with the pane and the text to complete and should return either nil, the completed text as a string or a list completions of candidate completions. In the latter case, the CAPI will prompt the user for the completion they wish, and this will become the new text. In addition, the completion-function can return two more values, start and end, which specify a range in the text that is to be replaced if the completion is successful.

When complete-do-action is non-nil, completion of the text in the pane automatically invokes callback (if callback is non-nil). The default value of complete-do-action is nil.

in-place-completion-function tells the pane to do in-place completion and specifies the function to use. The function should have signature:

in-place-completion-function pane string => completions, start, end

where pane is the text-input-pane itself and string is the string to complete. When in-place completion is invoked in-place-completion-function is called with pane and a string containing the text of pane to the left of the cursor.

completions needs to be a list of strings that are possible completions, a single string that is a unique completion, or the symbol :destroy. :destroy means that the in-place completion needs to stop and close the in-place window. In addition, the completion function can return two more values, start and end, which specify a range in the text that is to be replaced if the completion is successful. The function is called repeatedly whenever there is a change to the text that should be completed.

The default value of in-place-completion-function is nil.
file-completion, if non-nil, tells the pane to do file completion using an in-place window. The user invokes In-place completion or file completion by pressing the Up or Down key. “In-place completion” on page 168 for more details of the user interaction.

If file-completion is a pathname designator, its location is used as the root path for the completion.

The default value of file-completion is nil.

in-place-filter takes effect only when either in-place-completion-function or file-completion is non-nil. If in-place-filter is t then the in-place window can have a filter. Note that the filter needs to requested by a user gesture. Control+Return is the default in-place filter gesture. The default value of in-place-filter is t.

directories-only takes effect only if file-completion is used. If directories-only is t then in-place completion shows only directories. The default value of directories-only is nil.

ignore-file-suffices takes effect only if file-completion is used. It tells in-place completion to ignore files whose file namestring (the result of cl:file-namestring) ends with any of the strings in the list ignore-file-suffices. If ignore-file-suffices is :default, then completion uses the default value, which is the value of editor:*ignorable-file-suffices* (see config/a-dot-lispworks.lisp).

Notes: Completion

1. If in-place-completion-function needs some dynamic information, it can put it in a property of the pane (using capi-object-property).

2. For dynamic control over whether there is an in-place completion or not, specify an in-place-completion-function that simply returns the keyword :destroy when there should be no completion.

4. The in-place completion mechanism uses *gesture-callbacks* to implement the functionality.

5. :in-place-filter can be used to specify that the in-place window can have a filter.

6. The behavior of in-place completion is somewhat different from other completion.

7. The initargs :directories-only and :ignore-file-suffices can be used to change the behavior of the completion.

**Description:**

*Editing and navigation callbacks*

*navigation-callback*, if non-nil, is a function that will be called when certain navigation gestures are used in the *text-input-pane*. The function is called with two arguments, the pane itself, and one of the following keywords:

- **:tab-forward**
  
  *Tab was pressed.*

- **:tab-backward** *Tab Backwards* (usually *Shift+Tab*) was pressed.

- **:return** *Return* was pressed.

- **:shift-return** *Shift+Return* was pressed.

- **:enter** *Enter* was pressed.

- **:shift-enter** *Shift+Enter* was pressed.

When *navigation-callback* is non-nil, it is called instead of *callback* when *Return* is pressed. *callback* is still called via an OK button if there is one (see *buttons* below).

*navigation-callback* is implemented only on Microsoft Windows and Cocoa.

*editing-callback*, if non-nil, is a function of two arguments:

*editing-callback* *pane type*
pane is the text-input-pane and type is a keyword. editing-callback is called with type :start when the user starts editing and type :end when the user stops editing. In general, this occurs when the focus changes, but on Cocoa type :start is passed when the first change is made to the text.

Notes: Editing and navigation callbacks

Enter is the key usually found on the numeric keypad.

Description: Buttons

buttons specifies toolbar buttons which appear next to the pane and facilitate user actions on it. It also specifies the position of the buttons relative to the pane. This feature appears in the LispWorks IDE, for example the Class box of the Class Browser.

The allowed keys and values of the plist buttons are:

:ok A boolean or a plist, default value t. If true, a button which calls callback appears. If the value is a plist then this plist supplies details for the button, as described below.

:cancel A boolean or a plist, default value nil. If true, a button which calls cancel-function appears. A plist value is interpreted as for :ok and can also contain the key :accelerator which specifies an accelerator used for the button. There is no default accelerator.

:completion A boolean or a plist. If true, a button which calls completion-function appears. The default value is t if completion-function is non-nil, and nil otherwise. A plist value is interpreted as for :ok.
:browse-file

A keyword or a plist. If true, a button which invokes `prompt-for-file` appears. If the value is `:save` or `:open` then it is passed as the operation argument to `prompt-for-file`, replacing the text in the pane if successful. If the value is a plist, then it supplies details for the button, as described below, and can also contain the keywords `:message` to specify a message for the file prompter; `:pathname` to specify the default pathname of the file prompter (defaults to the text in the `text-input-pane`), `:directory` to use `prompt-for-directory` rather than `prompt-for-file`, or any of the keywords `:ok-check`, `:filter`, `:filters`, `:if-exists`, `:if-does-not-exist`, `:operation`, `:owner`, `:pane-args` or `:popup-args` which are passed directly to `prompt-for-file` or `prompt-for-directory`.

:cancel-function

A function that expects the pane as its single argument. The default is a function which sets `text` to the empty string.
:help Specifies a help button. The value must be a plist containing either keys :function and optionally :arguments, or the keys :title, :message and optionally :dialog-p.

If function is supplied, when the user presses the help button it calls

(apply function pane arguments)

where pane is the text-input-pane. title, message and dialog-p are ignored in this case.

Otherwise when the user presses the help button it opens a window with title displaying the string message in a display-pane. The message can be long, and can include newlines. The window is owned by the pane, but is not modal, so the user can interact with the pane while the help window is displayed. If dialog-p is true, the help window is raised as a dialog. The default value for dialog-p is nil. function and arguments are ignored in this case.

The plist can contain other keys as described below.

:orientation

The value is either :horizontal or :vertical. orientation controls the orientation of the toolbar. This is useful for multi-line-text-input-pane. The default value is :horizontal.

:adjust

The value is :top, :center, :centre or :bottom. adjust controls how the buttons are adjusted vertically relative to the text input pane. This is useful for multi-line-text-input-pane. The default value is :center.
:position: The value is :top, :bottom, :left or :right. position determines whether the buttons appear above, below, left or right of the text input pane. If :position is not supplied, then the buttons appear to the right of the pane.

The value nil for buttons means there are no buttons - this is the default. When buttons is true the buttons appear or not according to their specified values or their default values.

All of the button plists (for :ok, :cancel, :help and so on) can contain the following keys and values in addition to those mentioned above:

:enabled: A value that controls whether the button is enabled. (See the reader text-input-pane-buttons-enabled).

:image: The image to use for the button. This should be either a pathname or string naming an image file to load, a symbol giving the id of an image registered with register-image-translation, an image object as returned by load-image or an external-image. The default image is one of the symbols ok-button, cancel-button or complete-button, which are pre-registered image identifiers corresponding to each button.

:help-key: The help-key used to find a tooltip for the button.

The reader text-input-pane-buttons-enabled returns a list containing keywords such as :ok, :cancel and :completion, one for each corresponding button (as specified by buttons) that is currently enabled.
The writer (\texttt{setf text-input-pane-buttons-enabled})
takes a list of keywords as described for the reader and sets
the enabled state of the buttons, enabling each button if it
appears in the list and disabling it otherwise. The value \texttt{t} can
also be passed: this enables all the buttons.

Description: Search field and recent items

If \texttt{search-field} is a string and \texttt{recent-items-name} is not supplied,
then the value \texttt{search-field} is used as the name. See the discussion of recent-items below.

If any of \texttt{search-field}, \texttt{recent-items} or \texttt{recent-items-name} is sup-
plied and is non-nil, the pane uses \texttt{NSSearchField}, and also has "recent items". An \texttt{NSSearchField} has a different appearance from \texttt{text-input-pane}, can display recent items menu, and its input behavior is a little different too.

If \texttt{recent-items} is non-nil, it must be a list of strings, or \texttt{t}. When
it is a list of strings, it specifies the initial list of "recent items".
When it is \texttt{t}, it simply specifies that the pane should handle
recent items.

If \texttt{recent-items-name} is non-nil, it should be a string. The string
specifies the autosave name of the pane. When a pane has an
autosave name, Cocoa remembers the list of recent items for
pane with the same autosave name and same application.
The record persists between invocations of the application.

If \texttt{recent-items-name} is not supplied or is \texttt{nil}, and \texttt{search-field} is
a string, it is used instead as the name.

The maximum number of recent items defaults to 50 and can
be controlled by the initarg value \texttt{maximum-recent-items}. The
value \texttt{0} can be used to switch off the "recent items" feature,
including the menu.

The recent items list can be read and set by \texttt{text-input-
pane-recent-items}, or modified by any of \texttt{text-input-pane-replace-recent-items}, \texttt{text-input-pane-delete-}
recent-items, text-input-pane-append-recent-items, text-input-pane-prepend-recent-items and text-input-pane-set-recent-items.

The input behavior of text-input-pane with "recent items" is the same as that of other text-input-panes except for the timing of calls to callback. Note that this refers to the function that is passed with the initarg :callback, so change-callback is not affected.

By default, each time the user types a character it causes a scheduling of callback some short time later. If the user types another character before the callback, it is re-scheduled later. The result is that as long as the user types, there are no callbacks, but once the user stops a callback is generated.

The behavior of callback can be controlled by the initarg value recent-items-mode, which can be one of :explicit, :delayed or :immediate. :explicit gives the same behavior as a normal text-input-pane, :delayed is the default described above, and :immediate means doing a callback immediately after each character. In addition, when the user selects an item from the recent items menu or clicks its Cancel button, the callback is called. In the case of the Cancel button, the string would be empty.

Example

(capi:contain (make-instance 'capi:text-input-pane :text "Hello world"))

(setq tip (capi:contain
             (make-instance
              'capi:text-input-pane
              :enabled nil)))

(capi:apply-in-pane-process
     tip #'(setf capi:text-input-pane-enabled) t tip)

(capi:apply-in-pane-process
     tip #'(setf capi:text-input-pane-enabled) nil tip)

(capi:apply-in-pane-process
     tip #'(setf capi:text-input-pane-text) "New text" tip)
(capi:contain (make-instance
  'capi:text-input-pane
  :text "Hello world"
  :callback #'(lambda (text interface)
    (capi:display-message
     "Interface -S's text: ~S"
     interface text))))

This example uses a plist value for the buttons key :cancel to specify that the Cancel button is initially disabled:

(capi:contain
  (make-instance 'capi:text-input-pane
    :buttons
    '((:ok t :cancel (:enabled nil))))

This example shows how to specify a Help button which dis-
plays a help message:

(defvar *help-message* "A long help message."

(capi:contain
  (make-instance 'capi:text-input-pane
    :buttons
    `((:help
      (:title "help window"
       :message ,*help-message*))))

This example shows to specify a button which prompts for a
directory:

(capi:contain
  (make-instance 'capi:text-input-pane
    :buttons
    `((:browse-file (:directory t
                     :image :std-file-open)
       :ok nil))
    :title "Enter a directory path"

This example illustrates the use of gesture-callbacks. Ctrl+e
moves the cursor to the end of the input, Ctrl+a moves it to
the start, and Ctrl+6 does something else:
(capi:contain
 (make-instance 'capi:text-input-pane
 :gesture-callbacks
 (list
  (cons #\Ctrl-e
    #'(lambda (tip)
      (setf (capi:text-input-pane-caret-position tip)
            (length (capi:text-input-pane-text tip))))))
  (cons #\Ctrl-a
    #'(lambda (tip)
      (setf (capi:text-input-pane-caret-position tip) 0)))
  (cons #\Ctrl-6 'do-something-else)))))

There is a further example here:

(example-edit-file "capi/elements/text-input-pane")

See also
display-pane
editor-pane
multi-line-text-input-pane
set-text-input-pane-selection
text-input-choice
text-input-pane
text-input-pane-complete-text
text-input-pane-copy
text-input-pane-cut
text-input-pane-delete
text-input-pane-in-place-complete
text-input-pane-paste
text-input-pane-selected-text
text-input-pane-selection
title-pane
“Controlling Mnemonics” on page 13
“Displaying and entering text” on page 20
“Matching resources for GTK+” on page 269
text-input-pane-append-recent-items
text-input-pane-delete-recent-items
text-input-pane-prepend-recent-items
text-input-pane-replace-recent-items

Summary
Modifies the recent items list in a text-input-pane on Cocoa.

Signature
text-input-pane-append-recent-items text-input-pane &rest strings
text-input-pane-delete-recent-items text-input-pane &rest strings
text-input-pane-prepend-recent-items text-input-pane &rest strings
text-input-pane-replace-recent-items text-input-pane &rest strings

Arguments
text-input-pane A text-input-pane with recent items.
strings Strings.

Values
There is no meaningful return value.

Description
These functions modify the recent items list in a text-input-pane that has recent-items (see text-input-pane initargs :search-field, :recent-items and :recent-items-name).

text-input-pane-append-recent-items appends the strings at the end of the recent items, using text-input-pane-set-recent-items with where = :end.
text-input-pane-delete-recent-items deletes from the recent items any item that matches any of the strings (compared using cl:string-equal), using text-input-pane-set-recent-items with where = :delete.

text-input-pane-prepend-recent-items prepends the strings at the beginning of the recent items, using text-input-pane-set-recent-items with where = :start.

text-input-pane-replace-recent-items uses text-input-pane-set-recent-items with where = :replace, replacing the recent items in the pane by the strings. It has the same effect as (setf text-input-pane-recent-items), but takes the strings as &rest arguments.

Notes  

text-input-pane-append-recent-items, text-input-pane-delete-recent-items, text-input-pane-prepend-recent-items and text-input-pane-replace-recent-items are implemented only on Cocoa.

See also  
text-input-pane

text-input-pane-set-recent-items

text-input-pane-complete-text

Function

Summary  
Calls the completion-function in a text-input-pane.

Package  
capi

Signature  
text-input-pane-complete-text  pane => result

Arguments  
pane  
A text-input-pane.

Values  
result  
A string, or nil.
The function `text-input-pane-complete-text` calls the completion-function of pane with the current text. If this call is successful, then the text of pane is set to the result, and `text-input-pane-complete-text` returns this result. Otherwise, result is nil.

**Note:** the completion-function may return a list of completion candidates, in which case `text-input-pane-complete-text` prompts the user to select one of the candidates.

**See also** `text-input-pane`

---

**text-input-pane-copy**

**Summary**

Copies the selected text in a `text-input-pane` to the clipboard.

**Package**

capi

**Signature**

text-input-pane-copy text-input-pane

**Arguments**

text-input-pane An instance of `text-input-pane` or a sub-class.

**Description**

The function `text-input-pane-copy` performs the clipboard copy operation on the selected text in `text-input-pane`. It does nothing if there is no selection.

**See also** `clipboard`  
`text-input-pane`  
`text-input-pane-selection`  
`text-input-pane-cut`  
`text-input-pane-delete`  
`text-input-pane-paste`
text-input-pane-cut

Function

Summary  Cuts the selected text in a text-input-pane to the clipboard.

Package  capi

Signature  text-input-pane-cut text-input-pane

Arguments  text-input-pane  An instance of text-input-pane or a subclass.

Description  The function text-input-pane-cut performs the clipboard cut operation on the selected text in text-input-pane. It does nothing if there is no selection.

See also  clipboard
text-input-pane
text-input-pane-selection
text-input-pane-copy
text-input-pane-delete
text-input-pane-paste

text-input-pane-delete

Function

Summary  Deletes the selected text in a text-input-pane.

Package  capi

Signature  text-input-pane-delete text-input-pane

Arguments  text-input-pane  An instance of text-input-pane or a subclass.

Description  The function text-input-pane-delete deletes the selected text in text-input-pane. It does nothing if there is no selection.
See also

clipboard
text-input-pane
text-input-pane-selection
text-input-pane-cut
text-input-pane-copy
text-input-pane-paste

text-input-pane-in-place-complete  

Function

Summary

 Raises the non-focus completion window.

Signature
text-input-pane-in-place-complete text-input-pane

Arguments

 text-input-pane  A text-input-pane

Description

The function text-input-pane-in-place-complete raises the non-focus completion window.

The pane text-input-pane must have been made with either in-place-completion-function or file-completion. See the description of this functionality in text-input-pane.

See also

text-input-pane

text-input-pane-paste  

Function

Summary

 Pastes the clipboard text into a text-input-pane.

Package
capi

Signature
text-input-pane-paste text-input-pane

Arguments

 text-input-pane  An instance of text-input-pane or a subclass.
The function `text-input-pane-paste` performs the clipboard paste operation on `text-input-pane`, replacing any selected text.

See also
- `clipboard`
- `text-input-pane`
- `text-input-pane-selection`
- `text-input-pane-cut`
- `text-input-pane-copy`
- `text-input-pane-delete`

### `text-input-pane-recent-items` Function

**Summary**

Gets and sets the recent items in a `text-input-pane` on Cocoa.

**Signature**

```lisp
(text-input-pane-recent-items text-input-pane => list-of-strings)
(setf text-input-pane-recent-items) list-of-strings text-input-pane => list-of-strings
```

**Arguments**

- `text-input-pane` A `text-input-pane` with recent items.
- `list-of-strings` A list of strings.

**Description**

The function `text-input-pane-recent-items` gets and sets the recent items in a `text-input-pane` that has recent-items. (see `text-input-pane initargs :search-field, :recent-items and :recent-items-name`).

The value `list-of-strings` passed to `(setf text-input-pane-recent-items)` must be a list of strings.

**Notes**

`text-input-pane-recent-items` is implemented only on Cocoa.

`text-input-pane-recent-items` does not work properly before the pane is displayed.
See also  
  text-input-pane  
  text-input-pane-set-recent-items

**text-input-pane-selected-text**  
*Function*

**Summary**  
Returns the selected text in a text-input-pane.

**Package**  
capi

**Signature**  
text-input-pane-selected-text text-input-pane => result

**Arguments**  
text-input-pane  
An instance of text-input-pane or a subclass.

**Values**  
result  
A string or nil.

**Description**  
The function text-input-pane-selected-text returns the selected text in text-input-pane, or nil if there is no selection.

**See also**  
text-input-pane  
text-input-pane-selection  
text-input-pane-selection-p

**text-input-pane-selection**  
*Function*

**Summary**  
Returns the bounds of the selection in a text-input-pane.

**Package**  
capi

**Signature**  
text-input-pane-selection pane => start, end

**Arguments**  
pane  
A text-input-pane.

**Values**  
start, end  
Non-negative integers.
The function `text-input-pane-selection` returns as multiple values the bounding indexes of the selection in `pane`. That is, `start` is the inclusive index of the first selected character, and `end` is one greater than the index of the last selected character.

If there is no selection, then both `start` and `end` are the caret position in `pane`.

See also: `set-text-input-pane-selection`, `text-input-pane`, `text-input-pane-selected-text`, `text-input-pane-selection-p`
**text-input-pane-set-recent-items**

*Function*

**Summary**
Sets the recent items in a **text-input-pane**.

**Signature**
```
text-input-pane-set-recent-items text-input-pane strings where
```

**Arguments**
- **text-input-pane** A **text-input-pane** with recent items.
- **strings** A list of strings.
- **where** One of the keywords **:replace**, **:delete**, **:start** and **:end**, or a non-negative integer.

**Values**
**text-input-pane-set-recent-items** does not return a meaningful value.

**Description**
The function **text-input-pane-set-recent-items** sets the recent items in a **text-input-pane**. The **text-input-pane** must have recent items, that is it must have been created with one of the keyword arguments **:search-field**, **:recent-items** or **:recent-items-name**. The **strings** argument must be a list of strings.

**text-input-pane-set-recent-items** modifies the recent items according to the argument **where**, which can one of:

- **:replace** The strings replace the recent items in the text-input-pane.
- **:delete** Delete from the recent items any item that matches any of the string (using cl:string-equal).
- **:start** Insert the strings at the beginning of the recent items.
- **:end** Insert the strings at the end of the recent items.
A non-negative integer

Insert the strings at the position indicated by the value. 0 means the same as :start. If the integer is greater than the length of the current recent items list, the strings are inserted in the end of the list.

In all cases, if any of the strings is already in the recent-items list (as compared by cl:string-equal), it is first deleted from the list. This means that passing strings that already exist just moves them around in the list.

Notes

text-input-pane-set-recent-items is a little more efficient than using text-input-pane-recent-items and (setf text-input-pane-recent-items) but the different is unlikely to be significant.

See also

text-input-pane
text-input-pane-replace-recent-items
text-input-pane-delete-recent-items
text-input-pane-append-recent-items
text-input-pane-prepend-recent-items

text-input-range

Class

Summary

The class text-input-range is a pane for entering a number in a given range. Typically there are up and down buttons at the side which can used to quickly adjust the value.

Package
capi

Superclasses
titled-object
simple-pane

Initargs

:start An integer specifying the lowest possible value in the range.
An integer specifying the highest possible value in the range.

A generalized boolean.

An integer specifying the current value in the pane.

A function called when the value is changed by the user.

A function called when the user edits the text in the pane.

The type of arguments passed to the callback.

The class `text-input-range` provides numeric input of integers in a given range (some systems refer to this as a spinner or spin-box).

The range is controlled by the `start` and `end` initargs. `start` defaults to 0 and `end` defaults to 10. The initial value is set with the argument `value` (which defaults to 0).

`wraps-p` controls what happens if the user presses the up or down button until the start or end is reached. If `wraps-p` is `nil`, then it stops at the limit. If `wraps-p` is true then it wraps around to the other end. The default value of `wraps-p` is `nil`.

`callback`, if non-nil, should be a function to be called whenever the value is changed by the user. The arguments to callback are specified by `callback-type` (see the `callbacks` class for details of possible values, noting that the "data" is the value.
and the "item" is the pane itself). The default callback-type is (:item :data). Note that, if the value is changed by the user editing the text, then change-callback, if supplied, is called as well.

change-callback, if non-nil, should be a function of four arguments, to be called when the user edits the text in the pane. It should have this signature:

\[
\text{change-callback string pane interface caret-position}
\]

where the arguments are interpreted just as for the change-callback of text-input-pane. Note that editing of the text may or may not change the value in the text-input-range (that is, what text-input-range-value returns). If the value does change, then callback is called too.

Notes

On Cocoa, change-callback is not called for a cursor move only.

Example

(capi:contain
  (make-instance 'capi:text-input-range
    :start 0
    :end 100
    :value 42))

(example-edit-file "capi/elements/text-input-range")

See also
text-input-pane
text-input-choice
option-pane

title-pane

Class

Summary
This class provides a pane that displays a single line of text.

Package
capi

Superclasses
titled-object
simple-pane
Subclasses  
message-pane

Initargs  
:text  
The text to appear in the title pane.

Accessors  
title-pane-text

Description  
The most common use of title panes is as a title decoration for a pane, and so the class titled-object is provided as a class that supports placing title panes around itself.

A title-pane with text "Title" is created automatically when a titled-object is created with title "Title".

By default, a title-pane is constrained so that it cannot resize (that is, the values of visible-max-width and visible-max-height are t). This can be overridden by passing :visible-max-width nil or :visible-max-height nil.

Notes  
title-pane does not support the :pane-menu initarg on Microsoft Windows. If you need interaction, use display-pane or text-input-pane with :pane-menu and :enabled :read-only.

Example  
(setq title-pane (capi:contain
(make-instance
 'capi:title-pane
 :text "This is a title pane"))

(capi:apply-in-pane-process
 title-pane #'(setf capi:title-pane-text
 "New title" title-pane)

See also  
display-pane
text-input-pane
editor-pane
Chapter 3, “General Properties of CAPI Panes”
“Rendering of colors” on page 242
titled-menu-object

Class

Summary A deprecated class retained only for backward compatibility.

Package capi

Superclasses menu-object

Subclasses menu
menu-component
menu-item

Description The class titled-menu-object is deprecated, and left only for backward compatibility. Use menu-object instead.

See also menu-object

titled-object

Class

Summary The class titled-object is a mixin class which provides support for decorating a pane with a title (a piece of text positioned next to the pane) and with a message (a piece of text below the pane).

Package capi

Subclasses interface
layout
title-pane
display-pane
text-input-pane
toolbar
button-panel
list-panel
option-pane
progress-bar
output-pane
slider
Initargs

:title  A title string for the pane (or nil).
:title-args  Initargs to the title make-instance.
:title-font  The font used for the title.
:title-position  The position of the title.
:title-adjust  How to adjust the title relative to the pane.
:title-gap  The gap between the title and the pane.
:message  A message string for the pane (or nil).
:mnemonic-title  A string specifying the title and a mnemonic. Applies only to the subclasses specified below.
:message-gap  The gap between the message and the pane.

Accessors

titled-object-title
titled-object-title-font
titled-object-message
titled-object-message-font

Description

The titled pane makes its title decoration from a title-pane and the message decoration from a message-pane.

The text of the title-pane is passed via the titled-object initarg title and the text of the message-pane is passed via the titled-object initarg message.

The initargs and font for the title-pane are passed via the titled-object initargs title-args and title-font respectively.

title-gap specifies the size in pixels of the gap between the title and the pane. The default value of title-gap is 3.

For subclasses other than interface, the font used for the message can be found by titled-object-message-font and set by (setf titled-object-message-font).
message-gap specifies the size in pixels of the gap between the message and the pane. The default value of message-gap is 3.

The message is always placed below the pane, but the title’s position can be adjusted by specifying title-position which can be any of the following.

- :left Place the title to the left of the pane.
- :right Place the title to the right of the pane.
- :top Place the title above the pane.
- :bottom Place the title below the pane.
- :frame Place the title in a frame (like a groupbox) around the pane.

The title-adjust slot is used to adjust the title so that it is left justified, right justified or centered. The value of title-adjust can be any of the values accepted by the function pane-adjusted-offset, which are :left, :right, :top, :bottom, :center and :centre.

Note: title-adjust cannot handle both x and y. It is designed for cases like this:

```lisp
(capi:contain
 (make-instance 'capi:list-panel
   :items '(1 2 3 4 5)
   :title "Temp"
   :title-position :left
   :title-adjust :center
   :title-args
     '(:visible-min-width (:character 12)))))
```

mnemonic-title offers an alternate way to provide the pane’s title, and with a mnemonic. It takes effect only for button-panel, list-panel, list-view, option-pane, output-pane, progress-bar, scroll-bar, slider, text-input-pane, text-input-range, tree-view and their subclasses, and is interpreted as described for menu.

Note: titles and mnemonic titles can now be added in a grid-layout.
Compatibility note: titled-object corresponds to the LispWorks 4.1 class titled-pane. For backwards compatibility the accessors titled-pane-title and titled-pane-message, including setf methods, are provided. These simply trampoline to titled-object-title and titled-object-message, and may not be supported in future releases.

Example: Try each of these examples to see some of the effects that titled panes can produce. Note that text-input-pane is a subclass of titled-object, and that it has a default title-position of :left.

```
(capi:contain (make-instance 'capi:text-input-pane))
(capi:contain (make-instance 'capi:text-input-pane :title "Enter some text:"))
(capi:contain (make-instance 'capi:text-input-pane :title "Enter some text:" :title-position :top))
(capi:contain (make-instance 'capi:text-input-pane :message "A message"))
(capi:contain (make-instance 'capi:text-input-pane :message "A message" :title "Enter some text:"))
(capi:contain (make-instance 'capi:text-input-pane :title "Enter some text:" :title-args '(:foreground :red)))
```
See also message-pane
title-pane
“Controlling Mnemonics” on page 13
“Specifying titles” on page 17

titled-pinboard-object

Class

Summary
A pinboard object with a title.

Package
capi

Superclasses
pinboard-object
titled-object

Subclasses
image-pinboard-object

Description
The class titled-pinboard-object provides a pinboard object with a title. The title is regarded as part of the object in geometry calculations.

Notes
titled-pinboard-object does not allow the value :frame for the titled-object initarg title-position. The values :top, :bottom, :left and :right are allowed.

Example
This example creates three instances of titled-pinboard-object and one of item-pinboard-object, all with with a yellow background. Note that:

1. The title does not have the yellow background in the titled-pinboard-object, as opposed to the item-pinboard-object. To specify the title background, we pass it in the title-args.

2. The width of the title area is determined by the title, but passing :visible-min-width (and other geometric hints) can be used to override this.
3. Setting the `titled-object-title` of the `titled-pinboard-object` does not reset its width.

```
(setq tpo1 (make-instance 'capi:titled-pinboard-object
   :graphics-args
   '((:background :yellow)
     :x 10 :y 10
     :width 150 :height 20
     :title "Short"
     :title-position :left
     :title-args
     '(:background :red ))

  tpo2 (make-instance 'capi:titled-pinboard-object
   :graphics-args
   '((:background :yellow)
     :x 10 :y 40
     :width 150 :height 20
     :title "Long title"
     :title-position :left)

  tpo3 (make-instance 'capi:titled-pinboard-object
   :graphics-args
   '((:background :yellow)
     :x 10 :y 70
     :width 150 :height 20
     :title "Short"
     :title-position :left
     :title-args
     '(:visible-min-width 100))

  ipo (make-instance 'capi:item-pinboard-object
   :graphics-args
   '(:background :yellow)
   :x 10 :y 100
   :width 150 :height 20
   :text "Item Pinboard" ))

(setq pl (capi:contain
   (make-instance 'capi:pinboard-layout
     :visible-min-width 200
     :visible-min-height 200
     :description
     (list tpo1 tpo2 tpo3 ipo))))

(capi:apply-in-pane-process
 pl
  #'(lambda()
     (setf (capi:titled-object-title tpo1)
           "Longer...")))))
```
See also  
`item-pinboard-object`

“Creating graphical objects” on page 187

### toolbar

**Class**

**Summary**

This class provides a pane containing toolbar buttons and panes.

**Package**

capi

**Superclasses**

- `collection`
- `simple-pane`
- `titled-object`
- `toolbar-object`

**Initargs**

- `:dividerp` If `t`, a divider line is drawn above the toolbar, to separate it from the menu bar. The default value is `nil`.
- `:images` A list of images.
- `:callbacks` A list of callback functions.
- `:names` A list of names.
- `:texts` A list of strings.
- `:tooltips` A list of tooltip strings used on Microsoft Windows.
- `:button-width` The width of the toolbar buttons.
- `:button-height` The height of the toolbar buttons.
- `:stretch-text-p` A generalized boolean.
- `:image-width` The width of images in the toolbar.
- `:image-height` The height of images in the toolbar.
**:default-image-set**

An optional **image-set** object which can be used to specify images. See “image-list, image-set and image-locator” on page 64 for more details.

**:flatp**

A generalized boolean.

**Readers**

**toolbar-flat-p**

**Description**

The class **toolbar** inherits from **collection**, and therefore has a list of **items**. It behaves in a similar manner to **push-button-panel**, which inherits from **choice**.

The **items** argument may be used to specify a mixture of **toolbar-buttons** and **toolbar-components**, or it may contain arbitrary objects as items. The list may also contain CAPI panes, which will appear within the toolbar. This is typically used with **text-input-pane**, **option-pane**, and **text-input-choice**.

For items that are not toolbar buttons or toolbar components, a toolbar button is automatically created, using the appropriate elements of the **images**, **callbacks**, **names**, **texts** and **tooltips** lists. If no image is specified, the item itself is used as the image. For more information on acceptable values for **images**, see **toolbar-button**.

Each of the **images**, **callbacks**, **names**, **texts** and **tooltips** lists should be in one-to-one correspondence with the items. Elements of these lists corresponding to **toolbar-button** items or **toolbar-component** items are ignored.

**Note**: **:tooltips** is now deprecated. Use the interface **help-callback** with **help-key :tooltip** instead.

All toolbar buttons within the item list behave as push buttons. However, toolbar button components may have **:single-selection** or **:multiple-selection** interaction. See **toolbar-component** for further details.
button-width and button-height specify the size of each button in the toolbar. If a button contains text and stretch-text-p is true, then the button stretches to the width of the toolbar if needed.

images, if supplied, must specify images all of the same size. image-width and image-height must match the sub-image dimensions in default-image-set or the dimensions of the images.

flatp specifies whether the toolbar is ‘flat’ on Cocoa. If flatp is true, then the buttons do not have a visible outline until the user moves the mouse over them. flatp is only implemented on Cocoa. (On Microsoft Windows, all toolbars are flat. On Motif, no toolbar is flat.) The default value of flatp is :default.

**Notes**

1. text-input-pane, option-pane, and text-input-choice and so on cannot contain titles when embedded in a toolbar.

2. Rather than creating a toolbar explicitly you can add an interface toolbar by supplying the interface initarg :toolbar-items. This has the advantages that the toolbar is automatically positioned correctly within the window and has platform-standard behavior such as folding on Cocoa.

**See also**
collection
image-set
push-button-panel
toolbar-component
“image-list, image-set and image-locator” on page 64
“Non-standard toolbars” on page 134
“Working with images” on page 219
**toolbar-button**

**Summary**
This class is used to create instances of toolbar buttons.

**Package**
capi

**Superclasses**
item
toolbar-object

**Initargs**

:callback | A function that is called when the user presses the toolbar button and `popup-interface` is non-nil.

:image | Specifies the image to use for the toolbar button.

:selected-image | Specifies the image to use for the toolbar button when it is selected.

:tooltip | An optional string which is displayed, on Microsoft Windows, when the mouse moves over the button. :tooltip is deprecated.

:help-key | An object used for lookup of help. Default value t.

:remapped | Links the button to a menu item.

:dropdown-menu | A menu or nil.

:dropdown-menu-function | A function of no arguments, or nil.

:dropdown-menu-kind | One of the keywords :button, :only and :delayed.

:popup-interface | An interface or nil.
Toolbar buttons may be placed within toolbars and toolbar components. However, there is usually no need to create toolbar buttons explicitly; instead, the `callbacks` and `images` arguments to `toolbar` or `toolbar-component` can be used. To add tooltips, use the `interface` `help-callback` with `help-key :tooltip`.

In addition, an `interface` can have its own toolbar buttons, specified by its `toolbar-items`. No `toolbar` object is explicitly needed in that situation.

`image` and `selected-image` may each be one of the following:

A pathname or string

This specifies the filename of a file suitable for loading with `load-image`. Currently this must be a bitmap file.

A symbol

The symbol must either have been previously registered by means of a call to `register-image-translation`, or be one of the following symbols, which map to standard images:`:std-cut`, `:std-copy`, `:std-paste`, `:std-undo`, `:std-redo`, `:std-delete`, `:std-file-new`, `:std-file-open`, `:std-file-save`. 

```c

```
:std-print, :std-print-pre, 
:std-properties, :std-help, :std-find 
and :std-replace  
On Microsoft Windows, the following  
symbols are also recognized for view  
images: :view-large-icons, :view-  
small-icons, :view-list, :view-  
details, :view-sort-name, :view-sort-  
size, :view-sort-date, :view-sort-  
type, :view-parent-folder, :view-net-  
connect, :view-net-disconnect and  
:view-new-folder.  
Also on Microsoft Windows, these symbols  
are recognized for history images: :hist-  
back, :hist-forward, :hist-favorites,  
:hist-addtofavorites and :hist-  
viewtree.  
An image object, as returned by load-image.  
An image locator object  
This allows a single bitmap to be created  
which contains several button images side  
by side. See make-image-locator for more  
information. On Microsoft Windows, this  
also allows access to bitmaps stored as  
resources in a DLL.  
An integer  
This is a zero-based index into the default-  
image-set of the toolbar or toolbar compo-  
nent in which the toolbar button is used.  
Each image should be of the correct size for the toolbar. By  
default, this is 16 pixels wide and 16 pixels high.  

help-key is interpreted as described for element.
remapped, if non-nil, should match the name of a menu-item in the same interface as the button. Then, the action of pressing the button is remapped to selecting that menu-item and calling its callback. The default value of remapped is nil.

Toolbar buttons can be made with an associated dropdown menu by passing the :dropdown-menu or :dropdown-menu-function initargs.

If dropdown-menu is non-nil then it should be a menu object to display for the button.

If dropdown-menu-function is non-nil then it should be a function which will be called with the toolbar-button as its single argument. It should return a menu object to display for the button.

dropdown-menu-kind can have the following values:

:button There is a separate smaller button for the dropdown menu next to the main button.

:only There is no main button, only the smaller button for the dropdown.

:delayed There is only one button and the menu is displayed when the user holds the mouse down over the button for some short delay. If the user clicks on the button then the normal callback is called.

Note: dropdown-menu-kind is not supported for toolbar buttons in the interface toolbar-items list.

popup-interface, if non-nil, should be an interface. When the user clicks on the toolbar button, the interface popup-interface is displayed near to the button. The normal callback is not called, but you can detect when the interface appears by using its activate-callback. popup-interface is useful for popping up windows with more complex interaction than a menu can provide. The default value of popup-interface is nil.
Note: `popup-interface` is not supported for toolbar buttons in the `interface toolbar-items` list.

Toolbar buttons can display text, which should be in the `data` or `text` slot inherited from `item`.

Note: display of text in toolbar buttons is implemented only on Motif and Cocoa.

Example

A callback function:

```lisp
(defun do-redo (data interface)
  (declare (ignorable data interface))
  (capi:display-message "Doing Redo"))
```

A simple interface:

```lisp
(capi:define-interface redo ()
 ()
 (:panes
  (toolbar
capi:toolbar
  :items
  (list
   (make-instance
capi:toolbar-component
  :items
   (list (make-instance
      `capi:toolbar-button
    ;; remap it to the menu item
    :remapped 'redo-menu-item
    :image :std-redo)))))))
  (:menu-bar a-menu)
  (:menus
   (a-menu
    "A menu"
    ("Redo" :name 'redo-menu-item
      :selection-callback 'do-redo
      :accelerator "accelerator-y")))
  (:layouts
   (main
capi:row-layout
    '(toolbar)))
  (:default-initargs
   :title "Redo"))
```
In this interface, pressing the toolbar button invokes the menu item callback:

```lisp
(capi:display (make-instance 'redo))
```

This last example illustrates the use of `selected-image`.

```lisp
(capi:contain
  (make-instance 'capi:toolbar
    :items
    (list
      (make-instance 'capi:toolbar-component
        :interaction :multiple-selection
        :items
        (list (make-instance 'capi:toolbar-button
          :image 0
          :selected-image 1))))
    )))

See also

- item
- make-image-locator
- menu-item
- toolbar
- toolbar-component

“Toolips” on page 35
Chapter 9, “Adding Toolbars”
“Working with images” on page 219

### toolbar-component

**Class**

**Summary**

A toolbar component is used to group several toolbar buttons together. Each component is separated from the surrounding components and buttons.

Toolbar components are choices, and may be used to implement toolbars on which groups of buttons have single-selection or multiple-selection functionality.

**Package**

capi
Initargs

:image
A list of images, in one-to-one correspondence with the items. Elements corresponding to toolbar-button items or toolbar-component items are ignored

callbacks
A list of callback functions, in one-to-one correspondence with the items. Elements corresponding to toolbar-button items or toolbar-component items are ignored

:name
A list of names.

text
A list of strings.

tooltips
A list of tooltip strings, in one-to-one correspondence with the items. Elements corresponding to toolbar-button items or toolbar-component items are ignored

:default-image-set
An optional image-set object which can be used to specify images. See “image-list, image-set and image-locator” on page 64 for more details.

:selection-function
A function to dynamically compute the selection.

:selected-item-function
A function to dynamically compute the selected item.

:selected-items-function
A function to dynamically compute the selected items.
Description

The class `toolbar-component` inherits from `choice`, and hence has a list of `items`. Its behavior is broadly similar to `button-panel`.

The `items` argument may be used to specify a mixture of `toolbar-buttons` and `toolbar-components`, or may contain arbitrary objects as items. The list may also contain CAPI panes, which will appear within the toolbar. This is typically used with `text-input-pane`, `option-pane`, and `text-input-choice`.

For items that are not toolbar buttons or toolbar components, a toolbar button is automatically created, using the appropriate elements of the `images`, `callbacks`, `names`, `texts` and `tooltips` lists. If no image is specified, the item itself is used as the image. For more information on acceptable values for images, see `toolbar-button`.

No more than one of `selection-function`, `selected-item-function` and `selected-items-function` should be non-nil. Each defaults to `nil`. If one of these is non-nil, it should be a function which is called before the `toolbar-component` is displayed and when `update-toolbar` is called and which determines which items are selected. The function takes a single argument, which is the interface of the `toolbar-component`.

`selection-function`, if non-nil, should return a list of indices suitable for passing to the `choice` accessor `(setf choice-selection)`.

`selected-item-function`, if non-nil, should return an object which is an item in the `toolbar-component`, or is equal to such an item when compared by the `toolbar-component`'s `test-function` and `key-function`.

`selected-items-function`, if non-nil, should return a list of such objects.

Example

```lisp
(example-edit-file "capi/elements/toolbar")
```
See also toolbar
          toolbar-button
          “Toolips” on page 35
          Chapter 9, “Adding Toolbars”
          “Working with images” on page 219

toolbar-object

Class

Summary

This is a common superclass of all toolbar objects.

Package
capi

Superclasses
None

Subclasses
toolbar
          toolbar-button
          toolbar-component

Initargs

:enabled

If t, the toolbar object is enabled.

:enabled-function

A function determining the enabled state.

Accessors

simple-pane-enabled
          toolbar-object-enabled-function

Description

Any toolbar object may be disabled, by setting its enabled slot to nil. Disabling a toolbar or toolbar component prevents the user from interacting with any buttons contained in it.

All toolbar objects may also have an enabled-function specified. This is called whenever update-toolbar is called. If it returns t, the toolbar object will be enabled; if it returns nil, the object will be disabled.
Notes

The function enabled-function should not display a dialog or do anything that may cause the system to hang. In general this means interacting with anything outside the Lisp image, including files, databases and so on.

See also
toolbar
toolbar-button
toolbar-component
update-toolbar
Chapter 9, “Adding Toolbars”

**top-level-interface**

*Generic Function*

Summary

Returns the top level interface containing a specified pane.

Package

capi

Signature

top-level-interface pane

Description

Returns the top level interface that contains pane.

See also

top-level-interface-p
interface
element

“Hierarchy of panes” on page 27

**top-level-interface-display-state**

*Generic Function*

Summary

Returns a value which indicates how the top level interface is displayed.

Package

capi

Signature

top-level-interface-display-state interface
Arguments

<table>
<thead>
<tr>
<th>Arguments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>interface</td>
<td>A top level interface or dialog window</td>
</tr>
</tbody>
</table>

Description

Top level interfaces and dialogs can be manipulated by the user, such as being iconifed or maximized. The program can manipulate these windows too. The function `top-level-interface-display-state` returns a value that indicates the current state of the interface `interface`. The following values can be returned:

- **:normal**
  The window is visible and has its normal size.

- **:maximized**
  The window is visible and has been maximized.

- **:iconic**
  The window is visible as an icon.

- **:hidden**
  The window is not visible.

- **:full-screen**
  The window is full screen (only supported on Mac OS X 10.7 and later). This value is only applicable when the `window-styles` list contains the keyword `:can-full-screen`.

These values can also be passed as the `:display-state` initial when making a top level interface.

In addition, the function `(setf top-level-interface-display-state)` can be used to change the state of a top level interface. The value can be set to one of the above, or to `:restore` if the current state is `:iconic` or `:hidden`. When set to `:restore`, the state will become `:normal` or `:maximized` depending on how the interface was visible in the past.

See also

- `top-level-interface-p`
- `top-level-interface-geometry`
- `set-top-level-interface-geometry`
- `interface`
- Chapter 7, “Programming with CAPI Windows”
**top-level-interface-geometry** 

*Generic Function*

**Summary**
Returns the geometry of the top level interface.

**Package**
capi

**Signature**
```lisp
top-level-interface-geometry interface => tx, ty, twidth, theight
```

**Arguments**
- `interface`  
  An interface.

**Values**
- `tx, ty, twidth, theight`  
  Integers.

**Description**
The generic function `top-level-interface-geometry` returns the coordinates of the given interface in a form suitable for use as the `:best-x`, `:best-y`, `:best-width` and `:best-height` initargs to `interface`. The value of `interface` should be a top level interface.

`tx` and `ty` are measured from the top-left of the screen rectangle representing the area of the primary monitor (the primary screen rectangle).

**Notes**
On Cocoa, the result does not account for the size of the interface toolbar, if present in `interface`.

**Example**
```lisp
;; Define and display an interface.
(capi:define-interface test () ()
  (:panes (panel capi:list-panel)))
(setq int (capi:display (make-instance 'test)))

;; Now manually position the interface somewhere.

;; Find where the interface is.
(multiple-value-setq (tx ty twidth theight)
  (capi:top-level-interface-geometry int))
```
;; Now manually close the interface.

;; Create a new interface in the same place.
(setq int
  (capi:display
   (make-instance
     'test
     :best-x tx
     :best-y ty
     :best-width twidth
     :best-height theight)))

See also
- `top-level-interface-p`
- `top-level-interface-display-state`
- `set-top-level-interface-geometry`
- `interface`

“Support for multiple monitors” on page 41
Chapter 7, “Programming with CAPI Windows”
“Querying and modifying interface geometry” on page 151

---

top-level-interface-geometry-key

**Generic Function**

**Summary**
Determines where the geometry of an interface is saved.

**Package**
capi

**Signature**
top-level-interface-geometry-key interface => key, product-name

**Arguments**
- `interface` A top level interface.

**Values**
- `key` A symbol.
- `product-name` A symbol, a string or a list of strings.

**Description**
The generic function `top-level-interface-geometry-key` returns as multiple values a key and a product name, which determine where the geometry of `interface` is saved. The saved geometry is used when displaying a future instance.
The supplied method on `interface` returns the class name of `interface` as the `key`, and `nil` as the `product-name`. You can define methods for your interfaces and products.

`key` must be a symbol.

`product-name` is used to derive the `product-registry-path`.

`product-name` can be a symbol which was previously defined to have a registry path by

```
(setf sys:product-registry-path).
```

`product-name` can alternatively be a string, which is taken directly as `product-registry-path`.

`product-name` can alternatively be a list of strings, denoting multiple path components. These are concatenated together with the appropriate separator for the platform to give `product-registry-path`.

The geometry of `interface` is saved at the path which is constructed by concatenating (with appropriate separators) these values:

```
user-path product-registry-path "Environment" (symbol-package key) (symbol-name key)
```

where `user-path` is the registry branch

HKEY_CURRENT_USER on Microsoft Windows and the home directory on Unix/Linux/AIX and Mac OS X.

**Note:** for your interface classes for which you want the geometry to be saved, define a method on `top-level-interface-save-geometry-p`.

**Note:** in an image delivered at delivery level 5, symbol names are removed by default. This breaks the saved geometry mechanism as the registry path is constructed using `symbol-name`. To make this work in a level 5 delivered image, explicitly keep the `key` symbol. See the *LispWorks Delivery User Guide* for details.
See also  

\texttt{top-level-interface-save-geometry-p}  
“Querying and modifying interface geometry” on page 151

\textbf{top-level-interface-p}  

\textit{Generic Function}

\textbf{Summary}  
The predicate for top level interfaces.

\textbf{Package}  
capi

\textbf{Signature}  
\texttt{top-level-interface-p pane \Rightarrow result}

\textbf{Arguments}  
\texttt{pane}  
A Lisp object.

\textbf{Values}  
\texttt{result}  
A boolean.

\textbf{Description}  
The generic function \texttt{top-level-interface-p} returns true if \texttt{pane} is a top level interface.

\textbf{See also}  
\texttt{top-level-interface}  
\texttt{top-level-interface-geometry}  
\texttt{top-level-interface-display-state}  
\texttt{interface}  
\texttt{element}  
“Hierarchy of panes” on page 27

\textbf{top-level-interface-save-geometry-p}  

\textit{Generic Function}

\textbf{Package}  
capi

\textbf{Signature}  
\texttt{top-level-interface-save-geometry-p interface \Rightarrow result}

\textbf{Arguments}  
\texttt{interface}  
A top level interface.

\textbf{Values}  
\texttt{result}  
A boolean.
Description

The generic function `top-level-interface-save-geometry-p` returns true if the geometry of `interface` should be saved for use by a future instance.

The default method (on `interface`) returns `nil`.

See also

`top-level-interface-geometry-key`
“Querying and modifying interface geometry” on page 151

---

### tracking-pinboard-layout

**Class**

Summary

A pinboard with automatic highlighting.

Package

capi

Superclasses

pinboard-layout

Description

The class `tracking-pinboard-layout` provides a pinboard which tracks mouse movement by highlighting its objects as the mouse cursor moves over them.

This functionality is implemented via a :motion specification in the `input-model`. Therefore, you may not specify :motion in the `input-model` of a `tracking-pinboard-layout`. See `output-pane` for a description of `input-model`.

Example

```lisp
(example-edit-file "capi/graphics/tracking-pinboard-layout")
```

---

### tree-view

**Class**

Summary

A tree view is a pane that displays a hierarchical list of items. Each item may optionally have an image and a checkbox.

Package

capi
Superclasses  
  choice
  titled-object
  simple-pane

Initargs  
  :roots      A list of the root nodes.
  :children-function
              Returns the children of a node and hence defines the hierarchy in the tree.
  :leaf-node-p-function
              Optional function which determines whether a node is a leaf node (that is, has no children). This is useful if it can be computed faster than the children-function.
  :retain-expanded-nodes
              Specifies if the tree view remembers whether hidden nodes were expanded.
  :expandp-function
              A designator for a function of one argument, or nil.
  :action-callback-expand-p
              A boolean. The default value is nil.
  :delete-item-callback
              A function designator for a function of two arguments.
  :right-click-extended-match
              Controls the area within which selection by the mouse right button occurs. Default t.
  :has-root-line
              Controls whether the line and expanding boxes of the root nodes are drawn. Default t.
Initargs for handling check boxes. Note that these do not work on Cocoa:

**:checkbox-status**

Controls whether the tree has checkboxes, except on Cocoa. If non-nil, the value should be a non-negative integer less than the length of the image-list, or $t$.

An integer specifies the default initial status, and $t$ means the same as 2 (that is, by default the checkboxes are checked initially).

The default is nil, meaning no checkboxes.

**:checkbox-next-map**

Controls the change in status when the user clicks on a checkbox. Can be an array, a function or an integer. Default #(2 2 0).

**:checkbox-parent-function**

Controls the changes in the ancestors when the status of an item is changed.

**:checkbox-child-function**

Controls the changes in the descendants when the status of an item is changed.

**:checkbox-change-callback**

A function called when the status of an item is changed interactively.

**:checkbox-initial-status**

Specifies the initial status of specific items.

Initargs for handling images:

**:image-function**

Returns an image for a node.

**:state-image-function**

Returns a state image for a node.
:image-lists
A plist of keywords and **image-list** objects.

:use-images Flag to specify whether items have images. Defaults to `t`.

:use-state-images Flag to specify whether items have state images. Defaults to `nil`.

:image-width Defaults to 16.
:image-height Defaults to 16.

:state-image-width
Defaults to `image-width`.

:state-image-height
Defaults to `image-height`.

**Accessors**
- `tree-view-roots`
- `tree-view-children-function`
- `tree-view-image-function`
- `tree-view-state-image-function`
- `tree-view-leaf-node-p-function`
- `tree-view-retain-expanded-nodes`
- `tree-view-expandp-function`
- `tree-view-action-callback-expand-p`
- `tree-view-right-click-extended-match`
- `tree-view-has-root-line`
- `tree-view-checkbox-next-map`
- `tree-view-checkbox-parent-function`
- `tree-view-checkbox-status`
- `tree-view-checkbox-child-function`
- `tree-view-checkbox-change-callback`
- `tree-view-checkbox-initial-status`

**Readers**
- `tree-view-checkbox-status`
Description

The tree view pane allows the user to select between items displayed in a hierarchical list. Although it is a choice, only single selection interaction is supported. Use `extended-selection-tree-view` if you need other selection interaction styles.

The hierarchy of items in the tree is defined by the `children-function`, which must be a function taking a single argument and returning a list of children. When an item is expanded, whether programmatically, automatically, or in response to a user gesture, the system calculates what children this item has by calling the `children-function` on it.

What children the `children-function` returns for an item is up to you. However, the list must not include an object which is `cl: eql` to another object in the tree. To work sensibly it also needs to be consistent over time, that is return the same objects each time it is called, unless the state of the entity that the tree represents changes. It should also be reasonably fast, as the user will be waiting to see the items.

If the tree is supposed to display items that are "the same" in different parts of the tree, you can define a "wrapper", typically `cl: defstruct` with a few slots, and return a list of these wrappers (each pointing to the actual object). This wrapping is also useful for keeping other information related to the display in the tree, for example the string or the image to display, and maybe cache the children.

If `leaf-node-p-function` is not supplied, the `children-function` is also used to decide whether unexpanded nodes are leaf nodes or not (and hence whether to display the expanding box). If the `children-function` is slow, this may slow significantly the display of large trees. If it is possible to check for the existence of children faster, you should supply `leaf-node-p-function` to avoid this slow down.

The default value of `children-function` is `(constantly false)`, that is no children, and hence only the roots are displayed.
expandp-function controls automatic expansion of nodes (items) in the tree-view. By default, initially only the items specified by the roots argument are displayed. This initial display can be altered by supplying a function expandp-function which allows further items to be displayed. If supplied, expandp-function should be a function which is called on the roots and is called recursively on the children if it returns true. When the user expands a node, expandp-function is called on each newly created child node, which is expanded if this call returns true, and so on recursively. The default value of expandp-function is nil so that there is no automatic expansion and only the root nodes are visible initially.

The default value of retain-expanded-nodes is t.

Any item which has children has a small expansion button next to it to indicate that it can be expanded. When the user clicks on this button, the children nodes (as determined by the children function) are displayed.

If action-callback-expand-p is true, then the activate gesture expands a collapsed node, and collapses an expanded node. This expansion and contraction of the node is additional to any supplied action-callback.

delete-item-callback is called when the user presses the Delete key. Two arguments are passed: the tree-view and the selected item item. Note that, apart from calling the callback, the system does nothing in response to the Delete key. In particular, if you want to remove the selected item, delete-item-callback needs to do it by changing what the children-function returns when called on the parent of item. Normally you also need to to call tree-view-update-item with in-parent = t to actually update the tree on the screen.

Note also that in extended-selection-tree-view (a subclass of tree-view), if the interaction was not explicitly changed to :single-selection, the second argument to delete-item-callback is a list of the selected items (even when only one item is selected).
The `image-function` is called on an item to return an image associated with the item. It can return one of the following:

A pathname or string
This specifies the filename of a file suitable for loading with `load-image`. Currently this must be a bitmap file.

A symbol
The symbol must have been previously registered by means of a call to `register-image-translation`. It can also one of the following symbols, which map to standard images:

- `:std-cut`
- `:std-copy`
- `:std-paste`
- `:std-undo`
- `:std-redo`
- `:std-delete`
- `:std-file-new`
- `:std-file-open`
- `:std-file-save`
- `:std-print`
- `:std-print-pre`
- `:std-properties`
- `:std-help`
- `:std-find`
- `:std-replace`

On Microsoft Windows, the following symbols are also recognized. They map to view images:

- `:view-large-icons`
- `:view-small-icons`
- `:view-list`
- `:view-details`
- `:view-sort-name`
- `:view-sort-size`
- `:view-sort-date`
- `:view-sort-type`
- `:view-parent-folder`
- `:view-net-connect`
- `:view-net-disconnect`
- `:view-new-folder`

Also on Microsoft Windows, these symbols are also recognized. They map to history images:

- `:hist-back`
- `:hist-forward`
- `:hist-favorites`
- `:hist-addtofavorites`
- `:hist-viewtree`

An image object, as returned by `load-image`. 
An image locator object

This allowing a single bitmap to be created which contains several button images side by side. See `make-image-locator` for more information. On Microsoft Windows, it also allows access to bitmaps stored as resources in a DLL.

An integer

This is a zero-based index into the tree-view’s image lists. This is generally only useful if the image list is created explicitly. See `image-list` for more details.

The `state-image-function` is called on an item to determine the state image: an additional optional image used to indicate the state of an item. It can return one of the objects listed above, just as for `image-function`, or `nil` to indicate that there is no state image. See also `checkbox-status`, which overrides the `state-image-function`.

If `image-lists` is specified, it should be a plist containing the following keywords as keys. The corresponding values should be `image-list` objects.

- `:normal` Specifications an `image-list` object that contains the item images. The `image-function` should return a numeric index into this `image-list`.

- `:state` Specifications an `image-list` object that contains the state images. The `state-image-function` should return a numeric index into this `image-list`.

If `right-click-extended-match` is `nil`, the mouse right button gesture within the tree view selects an item only when the cursor is on the item. Otherwise, this gesture also selects an item to the left or right of the cursor. The default for `right-click-extended-match` is `t`. 
If `has-root-line` is `nil`, the vertical root line and expanding boxes of the root nodes are not drawn. This is useful in two cases:

- When the tree view needs to be neater. Note that the user does not have a mouse gesture to expand the root node. Normally the programmer would compensate for this by making some other gesture call `(setf tree-view-expanded-p)`.

- If a `children-function` is not supplied, this can be used to create a pane like a list view with checkboxes (see below for details of checkboxes). This pane can be handled as if it is a typical choice, except that setting the items is done by `(setf tree-view-roots)` or by passing `:roots` to `make-instance`. In a typical choice, you would do `(setf collection-items)` or pass `:items` to `make-instance`.

The default for `has-root-line` is `t`.

If the `checkbox-status` is non-nil then the tree view provides an automatic way of using the state images as checkboxes (except on Cocoa where checkboxes are not supported). The `state-image` is defaulted to a set of images containing checkboxes and the `state-image-function` is ignored, but each `item` has a status that is a non-negative integer no greater than the number of images in `state-image-list`. The status specifies which image is displayed alongside `item`.

When `item` is expanded in the tree for the first time, the status of each child is set to `item`'s status. The status can be changed interactively by the user:

- Left mouse button on a checkbox changes its status.
- Space changes the status of all selected items.

The status can also be read and set programmatically (see `tree-view-item-checkbox-status`).

When the status of an item changes:
• The statuses of its ancestors may change if a `checkbox-parent-function` was supplied.

• The statuses of an item's descendants may change if a `checkbox-child-function` was supplied.

• A callback given by `checkbox-callback-function` will be called, if this was supplied.

By default checkboxes have three statuses indicated by images: un-checked(0), gray-checked(1) and checked(2). If an item is checked or un-checked, then all its descendants have the same status. If an item is gray-checked, then its descendants have various statuses. When the status of an item changes, all the descendants of that item change to the same status, and all its ancestors change to gray-checked.

For non-default status-changing behavior, specify `checkbox-next-map`. The value can be:

• An array of statuses. When the user clicks on item's checkbox, the status of item is used to index into `checkbox-next-map`, and the status at that index becomes the new status of item. For example, with the default checkbox-next-map, checked(0) changes to un-checked(2), gray-checked(1) changes to un-checked(2), and un-checked(2) changes to checked(0).

• A function of two arguments. The first argument is a list of items and the second argument is their current status (and if the items have various statuses, the most common is used). `checkbox-next-map` should return the new status to use.

• An integer: the status is increased by 1, until this integer is reached, at which point the status becomes 0 again.

When the status of an item is changed, the statuses of items above and below it in the tree may also be changed: the system recurses up and down the tree using `checkbox-parent-function` and `checkbox-child-function` respectively.
To recurse upwards, *checkbox-parent-function* is called on the parent with five arguments: the parent, the parent’s status, the item, the item’s status and an flag which is non-nil if all the items at the same level as the item now have the same status:

\[\text{checkbox-parent-function parent parent-status item item-status all-items-same-p} \Rightarrow \text{new-parent-status, recurse-up, recurse-down}\]

If `new-parent-status` differs from `parent-status`, then the status of `parent` is set to `new-parent-status`. If `recurse-up` is non-nil, then the system recurses up from `parent`, and if `recurse-down` is non-nil, the system recurses down. The default `checkbox-parent-function` returns \(\text{(values new-item-status t nil)}\) where `new-item-status` is `item-status` if `all-items-same-p` is non-nil and 1 otherwise.

To recurse downwards, *checkbox-child-function* is called on each child with four arguments and the results are used similarly to those of *checkbox-parent-function*:

\[\text{checkbox-child-function child child-status item item-status} \Rightarrow \text{new-child-status, recurse-up, recurse-down}\]

The default `checkbox-child-function` returns \(\text{(values parent-status nil t)}\).

**Note:** if an item has never been expanded, then it has no children. If an item has been collapsed, then it has children even though they are not currently visible.

*checkbox-parent-function* and *checkbox-child-function* should not modify the tree in any way.

*checkbox-change-callback* takes three arguments: the tree, a list of items and their new status:

\[\text{checkbox-change-callback tree items new-status}\]

This is called after the new statuses of *items* and their ancestors and descendants have been resolved.
`checkbox-initial-status` is used the first time that each specified item, which can be anywhere in the tree, appears. The value is a list of conses of items and their initial statuses, for example `((item1. 2) (item2. 0))`. When `item` is displayed, its status is set from this list or, if `item` is not specified, from `checkbox-status`. Items are removed from the list when they are displayed and setting the list does not affect the checkbox status of items that have already been displayed. Note that check boxes are not supported on Cocoa.

The default value of `vertical-scroll` in a `tree-view` is `t`.

**Notes**

1. Since the items of a tree view are not computed until display time, the `choice initarg :selected-item` has no effect. See the examples in `interface-display` for a way to set the selected item in a tree view.

2. Although `tree-view` is a subclass of `collection`, it does its own items handling and you must not access its `items` and related slots directly. In particular for `tree-view` do not pass `:items`, `:items-count-function`, `:items-get-function` or `:items-map-function`, and do not use the corresponding accessors.

3. On Microsoft Windows, the system always sets the input focus to the `tree-view` after its `selection-callback` returns. If you need this callback to set the focus elsewhere, call `set-pane-focus` outside the callback, like this:

   ```lisp
   (mp:process-send process
     (list 'capi:set-pane-focus pane))
   ```

**Examples**

This example shows how to combine an XML parser with `tree-view` to display an RSS file.

```lisp
(ex example-edit-file "capi/applications/rss-reader")
```

There are further examples in Chapter 20, “Self-contained examples”.
See also  
choice  
extended-selection-tree-view  
tree-view-ensure-visible  
tree-view-expanded-p  
tree-view-item-checkbox-status  
tree-view-item-children-checkbox-status  
tree-view-update-item  
“CAPI elements” on page 2  
Chapter 5, “Choices - panes with items”  
“Working with images” on page 219  
Chapter 17, “Drag and Drop”

tree-view-ensure-visible

Function

Summary
Ensures that an item in a tree-view is visible.

Package
capi

Signature
tree-view-ensure-visible tree-view item

Arguments
tree-view A tree view.
item A displayed item of tree-view.

Description
The function tree-view-ensure-visible ensures that an item in a tree view is visible, scrolling the tree view if necessary.

Note that item must be an item that is displayed in tree-view.

See also tree-view

tree-view-expanded-p

Generic Function

Summary
Gets and sets the expanded state of an item in a tree-view.
**capi**

**Signature**

```lisp
(tree-view-expanded-p tree-view item => value)
```

**Signature**

```lisp
(setf tree-view-expanded-p) value tree-view item
```

**Arguments**

- `item`: An item.
- `value`: A boolean.

**Description**

The generic function `tree-view-expanded-p` is the predicate for whether `item` is expanded in `tree-view`. If `item` is not in `tree-view`, the function returns `nil`.

`(setf tree-view-expanded-p) value tree-view item` sets the expanded state of `item` in `tree-view` to `value`. If `item` is not in `tree-view`, the function does nothing.

**See also**

`tree-view`

---

**tree-view-item-checkbox-status**

*Function*

**Summary**

Gets and sets the checkbox status of an item in a `tree-view`.

**Package**

`capi`

**Signature**

```lisp
(tree-view-item-checkbox-status tree-view item => status)
```

**Signature**

```lisp
(setf tree-view-item-checkbox-status) status tree-view item
```

**Arguments**

- `tree-view`: A tree view.
- `item`: An item.
- `status`: A non-negative integer.
Description
The function `tree-view-item-checkbox-status` retrieves the checkbox status of `item` in `tree-view`, except on Cocoa. The function `(setf tree-view-item-checkbox-status)` sets the checkbox status of `item` in `tree-view`. The `status` must be a non-negative integer smaller than the number of images in `tree-view`'s `state-image-list`.

See also
- `tree-view`
- `tree-view-item-children-checkbox-status`

**tree-view-item-children-checkbox-status**

*Function*

**Summary**
Gets the checkbox statuses of a `tree-view` item's children.

**Package**
capi

**Signature**
`tree-view-item-children-checkbox-status tree-view item => result`

**Arguments**
- `tree-view` A `tree-view`.
- `item` An item.

**Values**
- `result` A list of conses `(child . status)` where each `child` is a child of `item` and `status` is `child`'s checkbox status.

**Description**
The function `tree-view-item-children-checkbox-status` returns `item`'s children together with their checkbox statuses, except on Cocoa. Note that, if `item` has not been expanded in `tree-view`, then it has no children and `result` will be `nil`.

See also
- `tree-view`
- `tree-view-item-checkbox-status`
### tree-view-update-an-item

**Generic Function**

**Summary**
Updates an item in a `tree-view`.

**Package**
capi

**Signature**
tree-view-update-an-item tree-view item in-parent

**Description**
The generic function `tree-view-update-an-item` is a synonym for `tree-view-update-item`.

**Notes**
tree-view-update-an-item is deprecated. Please use tree-view-update-item instead.

**See also**
tree-view
tree-view-update-item

### tree-view-update-item

**Generic Function**

**Summary**
Updates an item in a `tree-view`.

**Package**
capi

**Signature**
tree-view-update-item tree-view item in-parent

**Arguments**
- `tree-view` A `tree-view`.
- `item` An item.
- `in-parent` A boolean.
The generic function `tree-view-update-item` updates the item `item` in `tree-view`. This includes recomputing the text, images and children of `item`. This is useful when the data in `tree-view` changes, but the entire tree does not need recomputing.

When `in-parent` is non-nil, `tree-view-update-item` updates the children of the parent of `item`. This is useful when `item` is actually removed from `tree-view`, causing the children of its parent to be re-positioned.

See also `tree-view`

**undefine-menu**

*Macro*

**Package** capi

**Summary** Undefines a menu.

**Signature** `undefine-menu function-name &rest args`

**Description** This function undefines a menu created with `define-menu`.

**See also** `define-menu` `menu`

**unhighlight-pinboard-object**

*Function*

**Summary** Removes the highlighting from a `pinboard-object`.

**Package** capi

**Signature** `unhighlight-pinboard-object pinboard object &key redisplay => was-highlighted-p`

**Arguments** `pinboard` A `pinboard-layout`. 
object

A pinboard-object.

redisplay

A generalized boolean.

Values

was-highlighted-p

A boolean.

Description

The function unhighlight-pinboard-object removes the highlighting from a pinboard object if necessary, and then if redisplay is non-nil it redisplay it. The default value of redisplay is t.

To highlight a pinboard object use highlight-pinboard-object.

The returned value was-highlighted-p is true if object was highlighted before the call.

See also

highlight-pinboard-object

pinboard-object

uninstall-postscript-printer

Function

Summary

Uninstalls a Postscript printer definition.

Package
capi

Signature

uninstall-postscript-printer name &key if-does-not-exist deletep

Arguments

name

A string.

if-does-not-exist

One of nil or :error.

deletep

A boolean.

Description

Uninstalls a PostScript printer definition for the given device name.
This applies only on GTK+ and Motif.

*if-does-not-exist* controls what happens if the named printer does not exist. The default value is *:error*.

*deletep*, if true, causes the printer to be removed for subsequent sessions as well as the current session, by deleting the file on the disk. The default value of *deletep* is *nil*.

See also *install-postscript-printer*

“Printing on Motif” on page 252

### unmap-typeout

*Function*

**Package** capi

**Signature** `unmap-typeout collector-pane`

**Description** This switches the *collector-pane* out from its switchable layout, and brings back the pane that was there before *map-typeout* was called.

See also *map-typeout*

*with-random-typeout*

*collector-pane*

### update-all-interface-titles

*Function*

**Summary** Updates interface window titles.

**Package** capi

**Signature** `update-all-interface-titles`

**Description** The function *update-all-interface-titles* can be used to update all the *interface* window titles when needed.
This is useful when \texttt{interface-extend-title} may return a new, different, value.

\texttt{update-all-interface-titles} calls \texttt{update-screen-interface-titles} on all the screens.

\textbf{See also}

\texttt{interface-extend-title}
\texttt{update-screen-interface-titles}

\begin{description}
\item \textbf{update-drawing-with-cached-display}
\item \textbf{update-drawing-with-cached-display-from-points}
\end{description}

\textbf{Functions}

\textbf{Summary}

Updates the drawing using the cached display.

\textbf{Package}

capi

\textbf{Signature}

update-drawing-with-cached-display \texttt{pane} \texttt{&optional} \texttt{x y}
\texttt{width height}

update-drawing-with-cached-display-from-points \texttt{pane} \texttt{x1}
\texttt{y1 x2 y2 &key extend extend-x extend-y}

\textbf{Arguments}

\texttt{pane} \hspace{1cm} An output-pane.
\texttt{x, y, width, height} \hspace{0.5cm} Real numbers.
\texttt{x1, y1, x2, y2, extend, extend-x, extend-y} \hspace{1cm} Real numbers.

\textbf{Description}

The functions \texttt{update-drawing-with-cached-display} and \texttt{update-drawing-with-cached-display-from-points} update the drawing using the cached display, indicating the rectangle in which the \texttt{temp-display-callback} (argument to \texttt{start-drawing-with-cached-display}) needs to draw.

These functions must be called in the scope of \texttt{start-drawing-with-cached-display} or \texttt{output-pane-free-cached-display}. Calls outside this scope have no effect.
pane is the output pane to update. The other arguments specify the rectangle to be updated. The arguments are used in three ways: first they cause an implicit call to invalidate-rectangle with the appropriate arguments, secondly they define a mask that is used when calling the temp-display-callback, and third they provide arguments that are passed to the temp-display-callback.

In the case of update-drawing-with-cached-display, the arguments specify the rectangle in the standard way (the same way that they are passed to the display-callback). x and y default to 0, width defaults to the width of pane minus x, and height defaults to the height of pane minus y.

In the case of update-drawing-with-cached-display-from-points, the arguments specify two points, (x1,y1) and (x2,y2), which are corners of a rectangle. This rectangle is then extended horizontally in both directions by extend-x, and extended vertically in both directions by extend-y. The final result is:

\[
\begin{align*}
x &= (- \min x1 x2) \extend-x \\
y &= (- \min y1 y2) \extend-y \\
width &= (+ (- \max x1 x2) x) \extend-x \\
height &= (+ (- \max y1 y2) y) \extend-y
\end{align*}
\]

Notes
Omitting the rectangle (that is, calling update-drawing-with-cached-display with only the pane argument) causes all of the pane to be redisplayed each time. On slow displays, that may cause the display to be sluggish. On Windows and Cocoa with the normal settings, it is probably always fast enough, at least with modern machines. On GTK+ it depends on the speed of the connection to the X server, which in many cases is too slow for medium-size panes.
These calls also take care to redraw the area that was drawn by previous calls to the temp-display-callback, so you do not to do anything about erasing the results of previous calls.

Examples

This file shows how to use update-drawing-with-cached-display-from-points to redraw an arrowhead shape:

(example-edit-file "capi/output-panes/cached-display")

See also

start-drawing-with-cached-display
redraw-drawing-with-cached-display
“Transient display on output-pane and subclasses” on page 202

update-interface-title

Generic Function

Summary
Updates the title of an interface window.

Package
capi

Signature
update-interface-title interface

Arguments
interface A CAPI interface.

Description
The generic function update-interface-title updates the title of interface interface. This is useful when interface-extend-title may return a new, different, value.

You can specialize update-interface-title if needed.

To update all the interface titles, use update-all-interface-titles or update-screen-interface-titles.

See also
interface-extend-title
update-all-interface-titles
update-screen-interface-titles
**update-pinboard-object**

*Function*

Package: capi

Signature: `update-pinboard-object object`

Description: This function checks the object’s constraints, and adjusts the object’s size as necessary. It then forces the layout to redisplay the object at its new size. Finally, it returns `t` if a resize was necessary.

See also: `redraw-pinboard-object`

**update-screen-interface-titles**

*Function*

Summary: Updates interface window titles.

Package: capi

Signature: `update-screen-interface-titles screen`

Arguments: `screen` A CAPI `screen`.

Description: The function `update-screen-interface-titles` can be used to update the titles of all the interface windows on the screen `screen` when needed.

This is useful when `interface-extend-title` may return a new, different, value.

`update-screen-interface-titles` calls `update-interface-title` on all the relevant interfaces.

See also: `interface-extend-title`

`update-interface-title`
**update-screen-interfaces-hooks**

*Variable*

**Summary**
A list of functions that are called when a CAPI interface is created or destroyed. This variable is deprecated.

**Package**
capi

**Description**
Each function in the list *update-screen-interfaces-hooks* is called when an interface is created or destroyed.

Each function takes two arguments: the screen and the interface.

You should not remove system functions from this variable so take care if setting its value. Only add or delete your own functions.

**Notes**
*update-screen-interfaces-hooks* is deprecated. If you use it, please contact Lisp Support.

**update-toolbar**

*Function*

**Summary**
Updates a toolbar object.

**Package**
capi

**Signature**
update-toolbar self

**Description**
The function update-toolbar updates the toolbar object self. It computes the enabled function of self and the enabled functions of any toolbar components or toolbar buttons contained in it. Each toolbar object is enabled if the enabled function returns t, and is disabled if it returns nil.

**See also**
toolbar
toolbar-button
toolbar-component
### virtual-screen-geometry

**Function**

<table>
<thead>
<tr>
<th>Summary</th>
<th>Returns, as multiple values, a screen rectangle covering the full area of all the monitors associated with a screen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>capi</td>
</tr>
<tr>
<td>Signature</td>
<td><code>virtual-screen-geometry screen =&gt; x, y, width, height</code></td>
</tr>
<tr>
<td>Arguments</td>
<td><code>screen</code></td>
</tr>
<tr>
<td>Values</td>
<td><code>x</code></td>
</tr>
<tr>
<td></td>
<td><code>y</code></td>
</tr>
<tr>
<td></td>
<td><code>width</code></td>
</tr>
<tr>
<td></td>
<td><code>height</code></td>
</tr>
<tr>
<td>Description</td>
<td>The function <code>virtual-screen-geometry</code> returns the &quot;virtual&quot; geometry of the screen <code>screen</code>, which is a screen rectangle covering the full area of all the monitors that are associated with <code>screen</code>. The screen rectangle is at coordinates <code>x</code> and <code>y</code> as offsets from the top-left of the primary screen, with dimensions <code>width</code> and <code>height</code>.</td>
</tr>
<tr>
<td>See also</td>
<td><code>pane-screen-internal-geometry</code></td>
</tr>
<tr>
<td></td>
<td><code>screen-internal-geometries</code></td>
</tr>
<tr>
<td></td>
<td><code>screen-monitor-geometries</code></td>
</tr>
<tr>
<td></td>
<td>“Support for multiple monitors” on page 41</td>
</tr>
<tr>
<td></td>
<td>“Querying and modifying interface geometry” on page 151</td>
</tr>
</tbody>
</table>

### with-atomic-redisplay

**Macro**

| Summary | Delays the updating of specified panes until all state changes have been performed. |
Package      capi
Signature     with-atomic-redisplay (&rest panes) &body body
Description   The macro with-atomic-redisplay delays the updating of
               the specified panes and their descendants until the exit from
               the with-atomic-redisplay macro.
               Most CAPI pane slot writers update the visual appearance of
               the pane at the point that their state changes, but it is some-
               times necessary to cause all updates to the pane to be left
               until after they are all completed. The macro
               with-atomic-redisplay defers all visible changes to the
               state of each pane in panes until the end of the scope of the
               macro.
Notes         1. with-atomic-redisplay does not cause Graphics Ports
drawing operations to the panes to be deferred.
2. with-atomic-redisplay can be used recursively. The
   actual display happens when exiting the outermost invo-
   cation.
See also      display
              simple-pane

with-busy-interface  
Macro
Summary       Displays an alternate cursor during the execution of some
code, on platforms other than Cocoa.
Package       capi
Signature     with-busy-interface (pane &key cursor delay) &body body
The macro `with-busy-interface` switches the cursor of the interface containing `pane` to be the busy cursor, evaluates `body`, and then restores the cursor. This is useful when a piece of code may take significant time to run, and visual feedback should be provided.

`cursor` specifies the cursor to use while `body` is running. The default value is `:busy`. For other allowed values, see `simple-pane`.

`delay` specifies a time in seconds before the cursor is switched, so if `body` runs in less than `delay` seconds, then the cursor is not switched at all. This is usually more useful behavior than switching the cursor immediately. The default value of `delay` is 0.5.

`with-busy-interface` must be called in the process of the interface containing `pane`.

`with-busy-interface` has no effect on Cocoa.

See also `simple-pane`

### with-dialog-results

**Macro**

**Summary** Displays a dialog and executes a body when the dialog is dismissed.

**Package** `capi`

**Signature**

```lisp
(with-dialog-results (&rest results) dialog-form &body body => :continuation, nil)
```

**Arguments**

- `results` Variables.
- `dialog-form` A function call form.
- `body` Forms.
The macro `with-dialog-results` is designed to evaluate the `dialog-form` in a special way to allow dialogs on Cocoa to use window-modal sheets. It is not needed unless you want to make code that is portable to Cocoa. The `dialog-form` should be a function call form that displays a dialog.

The overall effect is that the `body` forms are evaluated with the `results` variables bound to the values returned by the `dialog-form` when the dialog is dismissed.

The dynamic environment in which the body is evaluated varies between platforms:

- On Microsoft Windows, GTK+ and Motif, the `with-dialog-results` macro waits until the dialog has been dismissed and then evaluates the `body` forms.
- On Cocoa, the `dialog-form` creates a sheet attached to the active window and the `with-dialog-results` macro returns immediately. The `body` forms are evaluated when the user dismisses the sheet.

The `dialog-form` must be a cons with one of the following two formats:

- `(function-name . arguments)`
- `(apply function-name . arguments)`

The `function-name` is called with all the given `arguments`, plus an additional pair of arguments, `:continuation` and a continuation function created from `body`. In the first format, the additional arguments are placed after all the given `arguments`. In the second format, the additional arguments are placed just before the last of the given `arguments` (i.e. before the list of remaining argument to `apply`).

The continuation function binds the `results` variables to its arguments and evaluates the `body` forms. If there are more arguments than `results` variables, the extra arguments are discarded.
This macro is designed for use with function-names such as popup-confirm or prompt-for-string, which take a :continuation keyword. You can define your own such functions provided that they call one of the CAPI functions, passing the received continuation argument.

**Examples**

On Microsoft Windows, GTK+ and Motif, this displays a dialog, calls record-label-in-database when the user clicks OK and then returns. On Cocoa, this creates a sheet and returns; record-label-in-database will be called when the user clicks OK.

```lisp
(with-dialog-results (new-label okp)
  (prompt-for-string "Enter a label")
  (when okp ; the user clicked in the OK button
     (record-label-in-database new-label)))
```

Here is an example with skeleton code for using with-dialog-results. Note that the dialog function (choose-file below) that is called by with-dialog-results must take a continuation keyword argument and pass it to a CAPI prompting function. Also note that the call to the CAPI prompting function must be the last form in the dialog function. Forms after the CAPI prompting function will be executed at an indeterminate time, and their values will not be used in the body of with-dialog-results.
(defun choose-file (&key continuation)
  (print 'in-choose-file)
  (capi:prompt-for-file "Choose File"
   :pathname "~/Desktop/"
   :continuation continuation))

(defun open-file (rep)
  (format t "Opening ~a~%" rep))

(defun my-callback ()
  (print 'doing-something-before)
  (capi:with-dialog-results (res ok-p)
    (choose-file)
    (print 'after-choose-file)
    (if ok-p
      (open-file res)
      (print 'cancelled)))))

(defun prompt-for-file-working ()
  (capi:contain
   (make-instance
    'capi:push-button
    :text "Click Here"
    :callback-type :none
    :callback 'my-callback)))

(prompt-for-file-working)

See also
  display-dialog
  popup-confirm

Chapter 11, “Dialogs: Prompting for Input”

with-document-pages

Macro

Summary
Executes a body of code repeatedly with a variable bound to
the number of the page to be printed each iteration.

Package
capi

Signature
with-document-pages page-var first-page last-page &body body
**Description**

The macro `with-document-pages` evaluates `body` repeatedly, with `page-var` bound to the number of the page to print on each iteration. It is used to by applications providing Page on Demand printing.

The `first-page` and `last-page` arguments are evaluated to yield the page numbers of the first and last pages in the document. `with-document-pages` takes care of `first-page` and `last-page` when the user sets them in `print-dialog`, by evaluating `body` for the pages that are in the intersection of what user chose and the other arguments.

`with-document-pages` must be called within the dynamic context of `with-print-job`.

**Notes**

The code in `body` should do the printing by calling standard GRAPHICS-PORTS drawing functions (see “Drawing functions” on page 212), typically also using `with-page-transform`.

**Examples**

(example-edit-file "capi/printing/fit-to-page")

(example-edit-file "capi/printing/multi-page")

(example-edit-file "capi/printing/page-on-demand")

**See also**

print-dialog

with-page

with-print-job

“Printing from the CAPI—the Hardcopy API” on page 249

---

**with-external-metafile**

---

**Macro**

**Summary**

Creates a metafile on disk using Graphics Ports operations.

**Package**

capi
Signature

\texttt{with-external-metafile (var &key pane bounds format pathname owner drawing-mode) &body body => nil}

Arguments

- \textit{var} \hspace{1em} A variable.
- \textit{pane} \hspace{1em} A graphics port, or \texttt{nil}.
- \textit{bounds} \hspace{1em} A list of four integers. Can also be \texttt{nil} on Microsoft Windows.
- \textit{format} \hspace{1em} One of the keywords :\texttt{enhanced}, :\texttt{enhanced-plus}, :\texttt{enhanced-gdi} and :\texttt{windows}.
- \textit{pathname} \hspace{1em} A pathname or string.
- \textit{owner} \hspace{1em} Specifies the owner of the metafile, which calls to \texttt{port-owner} will return. This has an effect only when \textit{pane} is \texttt{nil}.
- \textit{drawing-mode} \hspace{1em} One of the keywords :\texttt{compatible} and :\texttt{quality}.
- \textit{body} \hspace{1em} Code containing Graphic Ports operations that draw to \textit{var}.

Description

The macro \texttt{with-external-metafile} creates a metafile at the location given by \textit{pathname} containing records corresponding to the Graphics Ports operations in \textit{body} that draw to \textit{var}.

On Microsoft Windows the metafile is a device-independent format for storing pictures. For more information about metafiles, see the Microsoft documentation.

On Cocoa and GTK+ the metafile format is PDF.

If \textit{pane} is \texttt{nil}, the macro binds \textit{var} to an object of type \texttt{metafile-port}. If \textit{pane} is non-nil then it must be an instance of \texttt{output-pane} or a subclass. In this case \textit{var} is bound to \textit{pane}, and \textit{pane} is modified within the dynamic extent of \texttt{with-external-metafile} so all drawing operations draw to the
metafile instead of `pane`. This can be useful when reusing existing redisplay code that is written expecting an `output-pane`. The default value of `pane` is `nil`.

If `bounds` is `nil` the metafile size will be computed from the drawing done within the body. This value is not allowed on Cocoa.

If `bounds` is non-nil (required on Cocoa), it should be a list of integers specifying the coordinate rectangle `(x y width height)` that the metafile contains.

`pathname` specifies the filename of the metafile. If its `pathname-type` is `nil`, then the file extension "EMF" is used for an Enhanced-metafile, or "WMF" for a Windows-metafile.

`drawing-mode` should be either `:compatible` which causes drawing to be the same as in LispWorks 6.0, or `:quality` which causes all the drawing to be transformed properly, and allows control over anti-aliasing on Microsoft Windows and GTK+. The default value of `drawing-mode` is `:quality`.

For more information about `drawing-mode`, see “The drawing mode and anti-aliasing” on page 209.

On Cocoa and GTK+ the metafile format is always PDF as a single page, and the `format` argument is ignored. `format` is used only on Microsoft Windows and it can be one of:

- `:enhanced` Generate an Enhanced-metafile file containing "dual drawing" both in GDI+ and GDI.
- `:enhanced-plus` Generate an Enhanced-metafile file containing drawing only in GDI+.
- `:enhanced-gdi` Generate an Enhanced-metafile file containing drawing only in GDI.
- `:windows` Generate a Windows-metafile.

The default value of `format` is `:enhanced`. 
When `drawing-mode` is `compatible` (rather than the default value `quality`), `enhanced` and `enhanced-plus` behave like `enhanced-gdi`.

**Notes**

1. GDI+ gives the best quality, so normally that is what you would want. However some programs may be able to display only GDI (and not GDI+), which is why the default is dual drawing. This however generates a larger file and is presumably slightly slower, so if you are sure that the file will be used only by programs that can draw GDI+ emf files (sometimes called EMF+), you can use `format enhanced-plus`.

2. `with-external-metafile` is not implemented on X11/Motif.

See also

- `draw-metafile`
- `metafile-port`
- `port-owner`
- `with-internal-metafile`

Chapter 13, “Drawing - Graphics Ports”

**with-geometry**

*Macro*

**Summary**

Helps you to define layouts and create new `pinboard-object` subclasses.

**Package**

capi

**Signature**

`with-geometry pane &body body`

**Description**

The macro `with-geometry` is used for defining layouts and for creating new `pinboard-object` subclasses, by binding a set of variables to a pane’s geometry.
with-geometry binds the following variables across the forms in body to slots in the pane’s geometry in much the same way as the Common Lisp macro with-slots. Except the special cases which are mentioned below, these variables are read-only and should not be set.

Four variables define the geometry of the pane. If you define your own calculate-layout method, it can set these variables:

%x% An integer specifying the x position of the pane in pixels relative to its parent.

%y% An integer specifying the y position of the pane in pixels relative to its parent.

%width% An integer specifying the width in pixels of the pane.

%height% An integer specifying the height in pixels of the pane.

Four variables specify constraints on the pane. If you define your own calculate-constraints method, it can set these variables:

%min-width% A real number specifying the minimum width of the pane.

%min-height% A real number specifying the minimum height of the pane.

%max-width% A real number specifying the maximum width of the pane.

%max-height% A real number specifying the maximum height of the pane.

The following variables are also bound but apply only to classes with internal scrolling, such as editor-pane. They can be retrieved by get-horizontal-scroll-parameters
and get-vertical-scroll-parameters. They can be set by
set-horizontal-scroll-parameters and set-vertical-
scroll-parameters.

%scroll-width%
   The extent of the horizontal scroll range.
%scroll-height%
   The extent of the vertical scroll range.
%scroll-horizontal-page-size%
   The horizontal scroll page size.
%scroll-horizontal-slug-size%
   The width of the scroll bar slug.
%scroll-horizontal-step-size%
   The horizontal scroll step size.
%scroll-start-x%
   The start of the horizontal scroll range.
%scroll-start-y%
   The start of the vertical scroll range.
%scroll-vertical-page-size%
   The vertical scroll page size.
%scroll-vertical-slug-size%
   The height of the scroll bar slug.
%scroll-vertical-step-size%
   The vertical scroll step size.
%scroll-x%    x coordinate of the current scroll position.
%scroll-y%    y coordinate of the current scroll position

The following two variables access the object for which the
representation is:
%object%    The object whose geometry this is.
%child%      The same as %object% (kept for compatibility with LispWorks 3.1).
See also calculate-constraints
calculate-layout
convert-relative-position
element
get-horizontal-scroll-parameters
get-vertical-scroll-parameters
scroll
set-horizontal-scroll-parameters
set-vertical-scroll-parameters
“Accessing pane geometry” on page 28
Chapter 6, “Laying Out CAPI Panes”
Chapter 12, “Creating Panes with Your Own Drawing and Input”

with-internal-metafile  

Macro

Summary Creates a metafile in memory using Graphics Ports operations.

Package capi

Signature with-internal-metafile (var &key pane bounds format owner drawing-mode) &body body => metafile

Arguments

var A variable.
pane A graphics port, or nil.
bounds A list of four integers. Can also be nil on Microsoft Windows.
format One of the keywords :enhanced, :enhanced-plus and :enhanced-gdi.
owner Specifies the owner of the metafile, which calls to port-owner will return. This has an effect only when pane is nil.
The macro `with-internal-metafile` creates a metafile containing records corresponding to the Graphics Ports operations in `body` that draw to `var`.

`with-internal-metafile` behaves like `with-external-metafile` except that an object representing the metafile is returned, and no file is created on disk.

`var, pane, bounds, format, drawing-mode` and `body` are interpreted as for `with-external-metafile` except that `format` cannot have the value `:windows`.

**Note:** GDI+ gives the best quality, so normally that's what you want. But you cannot put a GDI+ only metafile on the clipboard, which is why the default is to make a "dual" metafile containing both GDI and GDI+ drawing. If are not going to put the metafile on the clipboard (by calling `set-clipboard` with `format :metafile`) you can use `format :enhanced-plus` which is slightly faster and uses less memory.

`metafile` must be freed after use, by calling `free-metafile`.

**Notes**

1. `with-internal-metafile` is supported on GTK+ only where Cairo is supported (GTK+ version 2.8 and later).

2. On GTK+, the internal metafile is slow to resize, so it is probably not useful when it is frequently resized (that is, drawn with different width or height).

3. `with-internal-metafile` is not implemented on X11/Motif.

**Examples**

```lisp
(example-edit-file "capi/graphics/metafile")
(example-edit-file "capi/graphics/metafile-rotation")
```
with-output-to-printer

Macro

Summary
Binds a stream variable and prints its output.

Package
capi

Signature
with-output-to-printer (stream &key printer tab-spacing interactive jobname)
&body body => result

Arguments
stream A variable.
printer A printer or nil.
tab-spacing An integer.
interactive A boolean.
jobname A string.

Values
result The result of evaluating body.

Description
The macro with-output-to-printer binds the variable stream to a stream object, and prints everything that is written to it in the code of body.

If interactive is t then print-dialog is called to select the printer to use. If interactive is nil then printer is used unless it is nil in which case the current-printer is used. The default value of interactive is t and the default value of printer is nil.
The values of jobname and tab-spacing are passed to print-text, which is used to actually do the printing. The default value of tab-spacing is 8 and the default value of jobname is "Text".

See also
- current-printer
- print-dialog
- print-text
- “Printing from the CAPI—the Hardcopy API” on page 249

**with-page**

*Macro*

**Summary**

Binds a variable to either t or nil, and executes a body of code to print a page only if the variable is t.

**Package**
capi

**Signature**

with-page (printp) &body body

**Description**

The macro with-page binds printp to t if a page is to be printed, or nil if it is to be skipped. The body is executed once, and is expected to draw the document only if printp is t.

Each call to with-page contributes a new page to the document.

with-page must be called within the dynamic context of with-print-job.

**Notes**

1. with-page does not work on Cocoa.

2. The code in body should do the printing by calling standard GRAPHICS-PORTS drawing functions (see “Drawing functions” on page 212), typically also using with-page-transform.
3. `printp` can be `nil` when only part of the document is printed, for example when the user specifies that she wants only odd pages. When `printp` is `nil`, the code in `body` needs to ensure that the next call to `with-page` prints the right page.


See also

- `with-document-pages`
- `with-page-transform`
- `with-print-job`
- “Printing from the CAPI—the Hardcopy API” on page 249

### `with-page-transform`  

**Macro**

**Summary**

Defines a rectangular region within the coordinate space of an output pane or printer port.

**Package**

capi

**Signature**

```
with-page-transform (x y width height) &body body
```

**Description**

The macro `with-page-transform` evaluates `x`, `y`, `width` and `height` to define a rectangular region within the coordinate space of an output pane or printer port. Within `body` the region is mapped onto the printable area of the page. If the specified rectangle does not have the same aspect ratio as the printable area of the page, then non-isotropic scaling will occur.

Any number of calls to `with-page-transform` can occur during the printing of a page; for example, it is sometimes convenient to use a different page transform from that used to print the main body of the page when printing headers and footers.
with-print-job

Macro

Summary

Creates a print job that prints to the specified printer.

Package
capi

Signature

with-print-job (var &key jobname printer owner drawing-mode) &body body

Description

The macro with-print-job creates a print job which prints to printer. If printer is not specified, the default printer is used. The macro binds var to a graphics port object, and printing is performed by using Graphics Ports operations to draw the object.

If pane is non-nil it must be an instance of output-pane or a subclass. In this case var is bound to pane, and pane is modified within the dynamic extent of the with-print-job so all drawing operations draw to the printer instead of pane. This can be useful when implementing printing by modifying existing redisplay code that is written expecting an output-pane. If pane is nil, var is bound to a graphics port of type printer-port, which is alive only inside the body of with-print-job, and sends any drawing into it to the printer.
jobname is the name of the print job. The default value is nil, meaning that the name "Document" is used.

The actual printing is done by using one of the macros with-document-pages or with-page, within the scope of with-print-job.

owner specifies the owner of the printer port object, which calls to port-owner will return. This has an effect only when pane is nil.

drawing-mode should be either :compatible which causes drawing to be the same as in LispWorks 6.0, or :quality which causes all the drawing to be transformed properly, and allows control over anti-aliasing on Microsoft Windows and GTK+. If pane is supplied, then pane determines the print job's drawing-mode, otherwise the default value of drawing-mode is :quality.

For more information about drawing-mode, see “The drawing mode and anti-aliasing” on page 209.

Examples

(example-edit-file "capi/graphics/metafile")
(example-edit-file "capi/printing/fit-to-page")
(example-edit-file "capi/printing/multi-page")
(example-edit-file "capi/printing/page-on-demand")

See also

port-owner
printer-port-handle
printer-port-supports-p
set-printer-options
with-document-pages
with-page
with-page-transform

“Printing from the CAPI—the Hardcopy API” on page 249
Chapter 13, “Drawing - Graphics Ports”
**with-random-typeout**  
*Macro*

**Summary**  
Binds a stream variable to a collector pane.

**Package**  
capi

**Signature**  
`with-random-typeout (stream-variable pane) &body body`

**Description**  
The macro **with-random-typeout** binds the variable `stream-variable` to a collector pane stream associated with `pane` for the scope of the macro. The collector pane is automatically mapped and unmapped around the body. If the body exits normally, the typeout is not unmapped until the space bar is pressed or the mouse is clicked.

**See also**  
map-typeout  
unmap-typeout  
collector-pane

**wrap-text**  
*Function*

**Summary**  
Wraps text for a given character width.

**Package**  
capi

**Signature**  
`wrap-text text width &key start end => strings`

**Arguments**  
`text`  
A string.

`width`  
A positive integer.

`start, end`  
Bounding index designators of `text`.

**Values**  
`strings`  
A list of strings.
Description The function \texttt{wrap-text} takes a string \texttt{text} and returns a list of strings, each of which is no longer than \texttt{width}. Together the strings in \texttt{strings} contain all the non-whitespace characters of \texttt{text} between \texttt{start} and \texttt{end} and are suitable for displaying this text on multiple lines of length \texttt{width}.

See also \texttt{wrap-text-for-pane}

\textbf{wrap-text-for-pane}

\textbf{Function}

\textbf{Summary} Wraps text for a given pane.

\textbf{Package} \texttt{capi}

\textbf{Signature} \texttt{wrap-text-for-pane pane text \&key external-width visible-width font start end => strings}

\textbf{Arguments}

- \texttt{text} A string.
- \texttt{pane} A displayed CAPI pane.
- \texttt{external-width} An integer or \texttt{nil}.
- \texttt{visible-width} An integer or \texttt{nil}.
- \texttt{font} A font object.
- \texttt{start} An integer.
- \texttt{end} An integer or \texttt{nil}.

\textbf{Values} \texttt{strings} A list of strings.

\textbf{Description} The function \texttt{wrap-text-for-pane} takes a string \texttt{text} and returns a list of strings. Together the strings in \texttt{strings} contain all the non-whitespace characters of \texttt{text} and are suitable for displaying this text on \texttt{pane}. That is, each string has a display width no greater than the width of \texttt{pane} when drawn using
the font of pane. The arguments start and end are used as bounding index designators for text and characters outside these bounds are ignored.

If visible-width is non-nil then text is wrapped to that width. Otherwise, if external-width is non-nil then text is wrapped as if the pane had that external width (that is, taking account of any borders in the pane). If both visible-width and external-width are nil, then the text is wrapped to the current visible width of the pane. The default value of both visible-width and external-width is nil.

The font is used to perform the wrapping calculations. If it is nil (the default), then the graphics-state-font is used for panes such as output-pane that have a graphics-state and the simple-pane-font is used for other panes.

See also wrap-text

x-y-adjustable-layout

Class

Summary The class x-y-adjustable-layout provides functionality for positioning panes in a space larger than themselves (for example, it is used to choose whether to center them, or left justify them).

Package capi

Superclasses layout

Subclasses simple-layout
grid-layout

Initargs :x-adjust The adjust value for the x direction.
:y-adjust The adjust value for the y direction.
Accessors

- layout-x-adjust
- layout-y-adjust

Description

The values $x$-adjust and $y$-adjust of the slots are used by layouts to decide what to do when a pane is smaller than the space in which it is being laid out. Typically the values will be a keyword or a list of the form (keyword $n$) where $n$ is an integer. These values of adjust are interpreted as by pane-adjusted-position.

:top is the default for $y$-adjust and :left is the default for $x$-adjust.

Example

Note: column-layout is a subclass of x-y-adjustable-layout.

```lisp
(setq column (capi:contain
  (make-instance
    'capi:column-layout
    :description (list
      (make-instance
        'capi:push-button
        :text "Ok")
      (make-instance
        'capi:list-panel
        :items '(1 2 3 4 5)
        )))))

(capi:apply-in-pane-process
  column #'(setf capi:layout-x-adjust) :right column)

(capi:apply-in-pane-process
  column #'(setf capi:layout-x-adjust) :center column)
```

See also

- pane-adjusted-position
The following chapter provides reference entries for the symbols exported from the `graphics-ports` package. You can use these to draw graphics in CAPI output panes, which are a kind of graphics port. See Chapter 13, “Drawing - Graphics Ports” for more information on graphics ports and their associated types.

**2pi**

*Constant*

**Summary**  
(* 2 pi) as a `double-float`.

**Package**  
graphics-ports

**Description**  
The constant 2pi is the result of (* 2 cl:pi). It is a cl:double-float.

**See also**  
fpi  
pi-by-2
analyze-external-image

**Function**

**Summary**
Gets the properties of DIB data in an external image.

**Package**
graphics-ports

**Signature**
analyze-external-image external-image => width height color-table number

**Arguments**
- external-image: An external-image.

**Values**
- width: An integer.
- height: An integer.
- color-table: A color table.
- number: An integer.

**Description**
The function `analyze-external-image` returns the width, height, color-table, and number of important colors for the external image `external-image`.

The image data in `external-image` must be in Device Independent Bitmap (DIB) format.

---

apply-rotation

**Function**

**Summary**
Modifies a transform such that a rotation of a given number of radians is performed on any points multiplied by the transform.

**Package**
graphics-ports

**Signature**
apply-rotation transform theta => transform

**Arguments**
- transform: A transform.
- theta: A real number.
The function **apply-rotation** modifies *transform* such that a rotation of *theta* radians is performed on any points multiplied by the transform. Any operations already contained in the transform occur before the new rotation.

The rotation is around the point (0,0).

If *theta* is positive, then the rotation is clockwise.

**apply-rotation** returns the transform.

See **graphics-state** for details of how a *transform* is used.

**Examples**

```lisp
(example-edit-file "capi/graphics/metafile-rotation")
```

**See also**

- **apply-rotation-around-point**
- **apply-scale**
- **apply-translation**
- **graphics-state**
- **transform**

---

**apply-rotation-around-point**

*Function*

**Summary**

Modifies a *transform* such that a specified rotation around a specified point is performed on any points multiplied by the transform.

**Package**

**graphics-ports**

**Signature**

```lisp
apply-rotation-around-point transform theta x y => transform
```

**Arguments**

- **transform** A *transform*.
- **theta** A real number.
- **x** A real number.
- **y** A real number.
The function `apply-rotation-around-point` modifies `transform` such that a clockwise rotation of \( \theta \) radians around the point \((x,y)\) is performed on any points multiplied by the transform. Any operations already contained in the transform occur before the new rotation.

`apply-rotation-around-point` returns the transform.

See `graphics-state` for details of how a `transform` is used.

There are further examples in Chapter 20, “Self-contained examples”.

See also
- `apply-rotation`
- `graphics-state`
- `transform`

**apply-scale**

**Function**

**Summary**

Modifies a `transform` such that a scaling occurs on any points multiplied by the transform.

**Package**

`graphics-ports`

**Signature**

`apply-scale transform sx sy => transform`

**Arguments**

- `transform` A `transform`.
- `sx` A real number.
- `sy` A real number.
Description

The function `apply-scale` modifies `transform` such that a scaling of `sx` in `x` and `sy` in `y` is performed on any points multiplied by the transform. Any operations already contained in the transform occur before the new scaling.

`apply-scale` returns the transform.

Notes

See `graphics-state` for details of how a `transform` is used.

Examples

(example-edit-file "capi/graphics/metafile-rotation")

See also

`apply-rotation`
`apply-rotation-around-point`
`apply-translation`
`graphics-state`
`transform`

---

**apply-translation**

*Function*

**Summary**

Modifies a transform such that a translation is performed on any points multiplied by the transform.

**Package**

`graphics-ports`

**Signature**

`apply-translation`  `transform`  `dx`  `dy`  `=>`  `transform`

**Arguments**

- `transform`  A `transform`
- `dx`  A real number.
- `dy`  A real number.

**Description**

The function `apply-translation` modifies `transform` such that a translation of `(dx dy)` is performed on any points multiplied by the transform. Any operations already contained in the transform occur before the new translation.

`apply-translation` returns the transform.
Notes  See graphics-state for details of how a transform is used.

Examples  (example-edit-file "capi/graphics/metafile-rotation")

See also  apply-rotation
          apply-rotation-around-point
          apply-scale
          graphics-state
          transform

**augment-font-description**  
*Function*

**Summary**  Returns a font description combining the attributes of a given font description with a set of font attributes.

**Package**  graphics-ports

**Signature**  augment-font-description fdesc &rest font-attribute* => return

**Arguments**  
  *fdesc*  A font description.
  *font-attribute*  A font attribute.

**Values**  return  A font description.

**Description**  The function augment-font-description returns a font description that contains all the attributes of fdesc combined with the extra font-attributes. The attribute :stock is handled specially: it is omitted from return, unless it is the only attribute specified.

If an attribute appears in both fdesc and a font-attribute, the value in the font-attribute is used. The contents of fdesc are not modified.

**See also**  make-font-description
Chapter 13, “Drawing - Graphics Ports”
clear-external-image-conversions  

**Function**

**Summary**
Clears external image conversions for a port.

**Package**
graphics-ports

**Signature**
clear-external-image-conversions  

external-image  

gp-or-null  

&key  

free-image  

all  

errorp

**Arguments**
- **external-image**: An external image.
- **gp-or-null**: A graphics port or nil.
- **free-image**: A boolean.
- **all**: A boolean.
- **errorp**: A boolean.

**Description**
The function `clear-external-image-conversions` clears the external image conversions for a port. If `gp-or-null` is nil all conversions are cleared using the image-color-users. If `all` is non-nil all conversions for all ports are cleared using `gp-or-null`. Conversions are also freed if `free-image` is non-nil. By default, `free-image` is `t`, `all` is `(null gp-or-null)`, and `errorp` is `t`.

**See also**
Chapter 13, “Drawing - Graphics Ports”

clear-graphics-port  

**Function**

**Summary**
Draws a filled rectangle covering the entire port in the port’s background color.

**Package**
graphics-ports

**Signature**
clear-graphics-port  

port

**Arguments**
- **port**: A graphics port.
The function `clear-graphics-port` draws a filled rectangle covering the entire port in the port's background. All other graphics state parameters are ignored.

### clear-graphics-port-state

**Function**

**Summary** Sets the graphics state of a port back to its default values.

**Package** `graphics-ports`

**Signature** `clear-graphics-port-state port`

**Arguments**

- `port` A graphics port.

**Description**
The function `clear-graphics-port-state` sets the graphics state of `port` back to its default values, which are the ones it possessed immediately after creation.

**See also** `graphics-state`

### clear-rectangle

**Function**

**Summary** Draws a rectangle in the port's background color.

`clear-rectangle` is deprecated.

**Package** `graphics-ports`

**Signature** `clear-rectangle port x y width height`

**Arguments**

- `port` A graphics port.
- `x` A real number.
- `y` A real number.
- `width` A real number.
Description

The deprecated function clear-rectangle draws the rectangle specified by x, y, width, and height in port’s background color. All other graphics-state parameters are ignored.

clear-rectangle is deprecated because it ignores the graphics state args, which means it does not work properly with other drawing functions. In particular, it does not work properly in the display-callback of output-pane.

Use instead:

(draw-rectangle pane x y width height
 :filled t
 :foreground color
 :compositing-mode :copy
 :shape-mode :plain)

compositing-mode is needed only when the color has alpha.

foreground is needed only if it is different from the foreground in the graphics state.

Note that draw-rectangle does take into account the transformation in the graphics-state.

See also
draw-rectangle

Chapter 13, “Drawing - Graphics Ports”

compress-external-image

Function

Summary
Compresses DIB data in an external image.

Package
graphics-ports

Signature
compress-external-image external-image => result

Arguments
external-image An external-image.
Values  result  The difference in bytes between size of the original image and the size of the compressed version.

Description  The function compress-external-image converts the external-image data into compressed DIB format.
The image data in external-image must be in Device Independent Bitmap (DIB) format.

**compute-char-extents**

*Function*

Summary  Returns the x coordinates of the end of each of the characters in a string if the string was printed to a graphics port.

Package  graphics-ports

Signature  compute-char-extents port string &optional font => extents

Arguments  

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>port</td>
<td>A CAPI pane.</td>
</tr>
<tr>
<td>string</td>
<td>A string.</td>
</tr>
<tr>
<td>font</td>
<td>A font.</td>
</tr>
</tbody>
</table>

Values  extents  An array of integers.

Description  Returns the extents of the characters in string in the font associated with port, or the font given. The extents are an array, one element per character, which gives the ending x coordinate of that character if the string was drawn to port.

**Note:** To compute the extents of the entire string for a given port or font, use port-string-width or get-string-extent.

See also  get-string-extent
port-string-width
**convert-external-image**

*Function*

**Summary**
Returns an image derived from an external image format.

**Package**
graphics-ports

**Signature**
`convert-external-image gp external-image &key cache force-new => image`

**Arguments**
- `gp`: A CAPI pane.
- `external-image`: An `external-image`.
- `cache`: A boolean.
- `force-new`: A boolean.

**Values**
- `image`: An `image`.

**Description**
The function `convert-external-image` returns an `image` derived from `external-image`. The image is ready for drawing to the given graphics port.

If `cache` is non-nil image conversions are cached in the `external-image`. The default value of `cache` is `nil`.

If `force-new` is non-nil a new image is always created, and put in the cache. The default value of `force-new` is `nil`.

**See also**
Chapter 13, “Drawing - Graphics Ports”

---

**convert-to-font-description**

*Function*

**Summary**
Converts a font-spec to a font description.

**Package**
graphics-ports

**Signature**
`convert-to-font-description port font-spec => fdesc`
Arguments

- `port` A graphics port
- `font-spec` A font description object, font or symbol

Values

- `fdesc` A font-description

Description

The function `convert-to-font-description` converts `font-spec` to a font description object `fdesc` for the graphics port `port`. If `font-spec` is a font, then its description is returned. If `font-spec` is a font description object, then it is returned. If `font-spec` is a symbol naming a font alias, then `convert-to-font-description` converts this alias to a font and returns its font description. Other platform-specific values of `font-spec` are also accepted.

See also

- `font-description`
- `make-font-description`

### copy-area

*Function*

Summary

Copies a rectangular area from one port to another.

Package

`graphics-ports`

Signature

`copy-area to-port from-port to-x to-y width height from-x from-y &rest args`

Arguments

- `to-port` A graphics port.
- `from-port` A graphics port.
- `to-x` A real number.
- `to-y` A real number.
- `width` A real number.
- `height` A real number.
- `from-x` A real number.
from-y

A real number.

args

graphics-state parameters passed as keyword arguments.

Description

The function copy-area copies a rectangular area from one port to another, taking account of transformations.

In drawing-mode :compatible (old drawing mode), copy-area does exactly the same as copy-pixels.

In drawing-mode :quality (the default) it copies a rectangular area from one port to another. The transform, mask, mask-transform, compositing-mode and shape-mode of to-port’s graphics-state are used. The to-port and from-port need not be the same depth. They can be the same object. The from-x and from-y values are interpreted as pixel positions in the window coordinates of from-port, that is, they are not transformed by from-port’s transform.

Notes

The main difference between copy-area and copy-pixels in drawing-mode :quality is when copying from a displayed window.

copy-area always copies using the right transformation of the target, but it means that it may copy from an obscured part of the window and hence copy the wrong thing. copy-pixels generates an exposure event on the target port instead of copying obscure areas, but to do that it has to ignore the transformation.

Examples

(example-edit-file "capi/graphics/compositing-mode")

See also

copy-pixels

graphics-state

Chapter 13, “Drawing - Graphics Ports”
**copy-external-image**

*Function*

**Summary**
Returns a copy of an external image.

**Package**
*graphics-ports*

**Signature**
```
copy-external-image external-image &key new-color-table => new-external-image
```

**Arguments**
- `external-image` An external image.
- `new-color-table` A color table.

**Values**
- `new-external-image` An external image.

**Description**
The function `copy-external-image` returns a copy of the `external-image`, optionally supplying a `new-color-table`. An error is signalled if this is a different size from the existing color-table.

**copy-pixels**

*Function*

**Summary**
Copies a rectangular area from one port to another.

**Package**
*graphics-ports*

**Signature**
```
copy-pixels to-port from-port to-x to-y width height from-x from-y &rest args
```

**Arguments**
- `to-port` A graphics port.
- `from-port` A graphics port.
- `to-x` A real number.
- `to-y` A real number.
- `width` A real number.
height: A real number.
from-x: A real number.
from-y: A real number.
args: graphics-state parameters passed as keyword arguments.

description: The function `copy-pixels` copies a rectangular area from one port to another. The transform, mask, mask-transform, compositing-mode and shape-mode from to-port’s graphics-state are used.

The (to-x to-y) is transformed according to to-port’s transform. When to-port’s drawing-mode is :quality the target is generally fully transformed, except that when it copies from a visible window it may generate expose events when copying from an obscured part, and in drawing-mode :quality it ignores the transformation in this case.

If to-port’s drawing-mode is :compatible then the image is not scaled or rotated. For more information about drawing-mode, see “The drawing mode and anti-aliasing” on page 209.

The to-port and front-port need not be the same depth and can be the same object. The from-x and from-y values are interpreted as pixel positions in the window coordinates of from-port, that is, they are not transformed by from-port’s transform.

Notes: `copy-pixels` can be used to draw to an output-pane inside the display-callback of that pane, but it cannot be used to copy from the output-pane inside its display-callback (the result of such an operation is not defined).

See also: `copy-area`, `output-pane`
Chapter 13, “Drawing - Graphics Ports”
**copy-transform**  
*Function (inline)*

Summary  
Returns a copy of a transform.

Package  
*graphics-ports*

Signature  
`copy-transform transform => result`

Arguments  
`transform`  
A `transform`.

Values  
`result`  
A `transform`.

Description  
The function `copy-transform` returns a copy of `transform`.

Notes  
See `graphics-state` for details of how a `transform` is used.

See also  
`graphics-state`  
`transform`

---

**create-pixmap-port**  
*Function*

Summary  
Creates a pixmap port and its window system representation.

Package  
*graphics-ports*

Signature  
`create-pixmap-port port width height &key background collect relative clear drawing-mode => pixmap-port`

Arguments  
`port`  
A graphics port for a window.

`width`  
An integer.

`height`  
An integer.

`background`  
A color designator.

`collect`  
A boolean.

`relative`  
A boolean.
clear A list or t.
drawing-mode One of the keywords :compatible and :quality.

Values

- pixmap-port A pixmap graphics port.

Description

The function create-pixmap-port creates a pixmap-port and its window system representation. The port argument specifies the color-user, used for color conversions, and its representation may also be used by the library to match the pixmap port properties. The value of background is used to initialize the graphics-state-background.

If clear is t, the pixmap is cleared to its background color, otherwise the initial colors will be non-deterministic. If clear is a list of the form (x y width height), only that part of the pixmap is cleared initially. The default value is nil.

If relative is non-nil, the pixmap graphics port collects pixel coordinates corresponding to the left, top, right, and bottom extremes of the drawing operations taking place within the body forms, and if these extend beyond the edges of the pixmap (into negative coordinates for example) the entire drawing is offset by an amount which ensures it remains within the port. It is as if the port moves its relative origin in order to accommodate the drawing. If the drawing size is greater than the screen size, then some of it is lost. The default value is nil.

If collect is non-nil, this causes the drawing extremes to be collected but without having the pixmap shift to accommodate the drawing, as relative does. The extreme values can be read using the get-bounds function. The default value of collect is relative.

See also

get-bounds
with-pixmap-graphics-port
Chapter 13, “Drawing - Graphics Ports”
### *default-image-translation-table*  
**Variable**

| Summary | The default image translation table. |
| Package | **graphics-ports** |
| Description | The variable *
  | *default-image-translation-table* contains the default image translation table. It is used if no image translation table is specified in calls to image translation table functions. |
| See also | **load-image** |

### define-font-alias  
**Function**

| Summary | Defines an alias for a font. |
| Package | **graphics-ports** |
| Signature | **define-font-alias** *keyword* *font* |
| Arguments |  
  | *keyword* | A keyword. |
  | *font* | A font or a *font-description* object. |
| Description | The function **define-font-alias** defines *keyword* as an alias for *font*. |
| Notes | Once a font alias is defined, it can be used to specify the *font* for a CAPI pane (see **simple-pane**). |
| See also | “Portable font descriptions” on page 217 |
**destroy-pixmap-port**  
*Function*

**Summary**  
Destroys a pixmap port, thereby freeing any window system resources it used.

**Package**  
*graphics-ports*

**Signature**  
`destroy-pixmap-port pixmap-port`

**Arguments**  
`pixmap-port`  
A pixmap port.

**Description**  
The function `destroy-pixmap-port` destroys a pixmap-port, freeing any window system resources.

**dither-color-spec**  
*Function*

**Summary**  
Returns `t` if the color specification for a given pixel should result in a pixel that is on in a 1-bit dithered bitmap.

**Package**  
*graphics-ports*

**Signature**  
`dither-color-spec rgb-color-spec y x`

**Arguments**  
`rgb-color-spec`  
An RGB specification.

`y`  
An integer.

`x`  
An integer.

**Values**  
`result`  
A boolean.

**Description**  
The function `dither-color-spec` returns `t` if `rgb-color-spec` should result in a pixel that is on in a 1-bit dithered bitmap. The current set of dithers is used in the decision.
dither-color-spec is deprecated. Dithers do not affect drawing or the anti-aliasing that occurs when drawing in Cocoa.

See also initialize-dithers
make-dither
with-dither

draw-arc

Function

Summary
Draws an arc.

Package graphics-ports

Signature draw-arc port x y width height start-angle sweep-angle &rest args &key filled

Arguments
port A graphics port.
x A real number.
y A real number.
width A real number.
height A real number.
start-angle A real number.
sweep-angle A real number.
args graphics-state parameters passed as keyword arguments.
filled A boolean.

Description
The function draw-arc draws an arc contained in the rectangle from (x y) to (x+width y+height) from start-angle to start-angle+sweep-angle. Both angles are specified in radians. Currently, arcs are parts of ellipses whose major and minor axes are parallel to the screen axes. When port's drawing-mode is
If the arc is transformed properly, but if `drawing-mode` is `:compatible` and `port` has rotation in its transform, the enclosing rectangle is modified to be the external enclosing orthogonal rectangle of the rotated rectangle. The start angle is rotated. The `transform`, `foreground`, `background`, `operation`, `pattern`, `thickness`, `scale-thickness`, `mask`, `shape-mode` and `compositing-mode` from the `port`'s `graphics-state` are all used, unless overridden in `args`. Additionally on X11/Motif only, `stipple` is used. When `filled` is non-nil, a sector is drawn.

See also `draw-arcs` `graphics-state` Chapter 13, “Drawing - Graphics Ports”

**draw-arcs**

**Function**

**Summary** Draws several arcs.

**Package** `graphics-ports`

**Signature**

```
(draw-arcs port description &rest args &key filled)
```

**Arguments**

- `port` A graphics port.
- `description` A description sequence.
- `filled` A boolean.
- `args` `graphics-state` parameters passed as keyword arguments.

**Description** The function `draw-arcs` draws several arcs as specified by the `description` sequence. This is usually more efficient than making several calls to `draw-arc`. The `description` argument is a sequence of values of the form `x y width height start-angle sweep-angle`. See `draw-arc` for more information.
See also

draw-arc

graphics-state

Chapter 13, “Drawing - Graphics Ports”

draw-character

Function

Summary

Draws a character in a given graphics port.

Package

graphics-ports

Signature

draw-character port character x y &rest args &key block

Arguments

port A graphics port.

calendar A character.

x A real number.

y A real number.

block A boolean.

args graphics-state parameters passed as keyword arguments.

Description

The function draw-character draws the character character at (x y) on the port. The transform, foreground, background, operation, stipple, pattern, mask, mask-transform, font, text-mode and compositing-mode from the port’s graphics-state are all used, unless overridden in args.

(x y) specifies the leftmost point of the character’s baseline.

block, if true, causes the character to be drawn in a character cell filled with the port’s graphics-state background.

Notes

The graphics-state parameter operation is not supported for drawing text on Windows.
See also  

**graphics-state**

Chapter 13, “Drawing - Graphics Ports”

draw-circle

**Function**

Summary  

Draws a circle.

Package  

**graphics-ports**

Signature  

\[\text{draw-circle} \quad \text{port} \quad x \quad y \quad \text{radius} \quad \text{&rest} \quad \text{args} \quad \text{&key} \quad \text{filled}\]

Arguments  

- **port**: A graphics port.
- **x**: A real number.
- **y**: A real number.
- **radius**: A real number.
- **args**: **graphics-state** parameters passed as keyword arguments.
- **filled**: A boolean.

Description  

The function **draw-circle** draws a circle of the given radius centered on \((x, y)\). The transform, foreground, background, operation, thickness, scale-thickness, mask, shape-mode and compositing-mode from the port’s **graphics-state** are all used, unless overridden in args. When filled is non-nil, the circle is filled with the foreground color.

Notes  

**draw-circle** does not work properly under a rotation transform (see **make-transform**). A workaround is to use a many-sided polygon drawn by **draw-polygon** which will be rotated correctly.

Example  

\[(\text{gp:draw-circle} \quad \text{port} \quad 100 \quad 100 \quad 20)\]
(gp:draw-circle port 100 100 50
  :filled t
  :foreground :green)

See also graphics-state
Chapter 12, “Creating Panes with Your Own Drawing and Input”

draw-ellipse

Function

Summary
Draws an ellipse.

Package
graphics-ports

Signature
draw-ellipse port x y x-radius y-radius &rest args &key filled

Arguments
port A graphics port.
x A real number.
y A real number.
x-radius A real number.
y-radius A real number.
radius A real number.
args graphics-state parameters passed as keyword arguments.
filled A boolean.

Description
The function draw-ellipse draws an ellipse of the given radii centered on (x y). The transform, foreground, background, operation, thickness, scale-thickness, mask, shape-mode and compositing-mode from the port's graphics-state are all used, unless overridden in args. When filled is true, the ellipse is filled with the foreground color.
Notes

1. **draw-ellipse** does not work properly under a rotation transform when *port's drawing-mode* is :compatible. A workaround is to use a many-sided polygon drawn by **draw-polygon** which will be rotated correctly.

2. **draw-ellipse** does work properly under any transform when *port's drawing-mode* is :quality.

3. See **make-transform** for information about rotation transforms.

4. For more information about *drawing-mode*, see “The drawing mode and anti-aliasing” on page 209.

Example

```
(gp:draw-ellipse port 100 100 20 40)
(gp:draw-ellipse port 100 100 50 10
  :filled t
  :foreground :green)
```

See also **graphics-state**

Chapter 13, “Drawing - Graphics Ports”

draw-image

*Function*

**Summary**
Displays an image on a graphics port at a given position.

**Package**
**graphics-ports**

**Signature**
```
draw-image port image to-x to-y &rest args &key from-x from-y
to-width to-height from-width from-height global-alpha
```

**Arguments**
- *port* A graphics port.
- *image* An **image**.
- *to-x*, *to-y* Real numbers.
- *args* **graphics-state** parameters passed as keyword arguments.
from-x, from-y  Real numbers.
to-width, to-height  Real numbers.
from-width, from-height  Real numbers.
global-alpha  A real number in the inclusive range [0,1], or nil.

Description  The function `draw-image` displays `image` on the port at `to-x` to `to-y`.
The default value of `from-x` and `from-y` is 0. The `from-width` and `from-height` arguments default to the size of the image. In addition, `to-width` defaults to `from-width` and `to-height` defaults to `from-height`.

When port’s drawing-mode is `compatible`, graphics state translation is guaranteed to be supported but support for scaling and rotation are library dependent. Specifically, scaling is supported in the Windows, Cocoa and GTK+ implementations, but not on X11/Motif.

When port’s drawing-mode is `quality`, the target coordinates are fully transformed according to the transformation in the `graphics-state`.

For more information about drawing-mode, see “The drawing mode and anti-aliasing” on page 209.

global-alpha, if non-nil, is a blending factor that applies to the whole image, in the Windows and Cocoa implementations, but not on X11/Motif or GTK+. The value 0 means use only the target (that is, do not draw anything) and the value 1 means use only the source (that is, normal drawing). Intermediate real values mean use proportions of both the target and source. The value nil also means normal drawing, and this is the default value.
Notes
On Microsoft Windows, if the image was loaded from a .ico file then `draw-image` ignores `from-x`, `from-y`, `from-width`, `from-height` and the `graphics-state` operation when drawing the image, and also `global-alpha` is ignored.

Compatibility note
In LispWorks 6.1 and earlier versions, the `to-width` and `to-height` arguments defaulted to the size of the image and `from-width` defaulted to `to-width` and `from-height` defaulted to `to-height`.

Examples
This example scales an image with various values of `from-width`, `to-width`, `from-height` and `to-height`. It illustrates the effect of the default of these value which has changed since LispWorks 6.1:

```
(exexample-edit-file "capi/graphics/image-scaling")
```

Further examples:

Draw the whole image at (10 20) without scaling:

```
(gp:draw-image port image 10 20)
```

Draw the whole image at (10 20) scaling it to 100x200:

```
(gp:draw-image port image 10 20
 :to-width 100
 :to-height 200)
```

Draw a 16x32 pixel rectangle from (60 80) in the image at (10 20) without scaling:

```
(gp:draw-image port image 10 20
 :from-x 60
 :from-y 80
 :from-width 16
 :from-height 32)
```

Draw a 16x32 pixel rectangle from (60 80) in the image at (10 20) scaling it to 100x200:
(gp:draw-image port image 10 20
 :from-x 60
 :from-y 80
 :from-width 16
 :from-height 32
 :to-width 100
 :to-height 200)

See also image
Chapter 13, “Drawing - Graphics Ports”

draw-line

Function

Summary
Draws a line between two given points.

Package graphics-ports

Signature
draw-line port from-x from-y to-x to-y &rest args

Arguments
port A graphics port.
from-x A real number.
from-y A real number.
to-x A real number.
to-y A real number.
args graphics-state parameters passed as keyword arguments.

Description
The function draw-line draws a line from (from-x from-y) to (to-x to-y).

The graphics-state parameters transform, foreground, background, operation, pattern, thickness, scale-thickness, dashed, dash, line-end-style, mask, shape-mode and compositing-mode are used. Additionally on X11/Motif only, stipple is used.
See also

draw-lines
graphics-state
Chapter 13, “Drawing - Graphics Ports”

draw-lines
Function

Summary
Draws several lines between pairs of two given points.

Package
graphics-ports

Signature
draw-lines port description &rest args

Arguments
port A graphics port.
description A description sequence.
args graphics-state parameters passed as keyword arguments.

Description
The function draw-lines draws several lines as specified by the description sequence. This is usually more efficient than making several calls to draw-line. The description argument is a sequence of values of the form x1 y1 x2 y2. See draw-line for more information.

See also
draw-line
graphics-state
Chapter 13, “Drawing - Graphics Ports”

draw-path
Function

Summary
Draws a path at a given point, optionally closing it or filling it.

Package
graphics-ports
### Signature

```
(draw-path port path x y &rest args &key closed filled fill-rule)
```

### Arguments

- **port**: A graphics port.
- **path**: A path specification.
- **x**: A real number.
- **y**: A real number.
- **closed**: A boolean.
- **filled**: A boolean.
- **fill-rule**: One of the keywords :even-odd and :winding.
- **args**: `graphics-state` parameters passed as keyword arguments.

### Description

The function `draw-path` draws the path `path` at `(x y)` in `port`.

When `closed` is non-nil, a line is drawn from the last point in the path to the start of the last figure in the path. When `filled` is non-nil, the path is filled, otherwise its outline is drawn; the `closed` argument is ignored if `filled` is non-nil. The `closed` argument is ignored if `filled` is non-nil. `transform`, `foreground`, `background`, `thickness`, `scale-thickness`, `dashed`, `dash`, `line-end-style`, `line-joint-style` and `mask` from `port`'s `graphics-state` (see `graphics-state`) are all used. `fill-rule` specifies how overlapping regions are filled. Possible values for `fill-rule` are :even-odd and :winding.

`path` is a path specification, which consists of path elements that describe a number of disconnected figures. The origin of the path is `(x y)`, so all other coordinates within the path are translated relative to that point.

The following formats of path specification are supported:

- A sequence of lists, each of which is a path element as described below.
A function designator to generate the path elements. Graphics ports calls the function when it wants to obtain the path elements. The function takes a single argument, which is a function that should be called with each path elements as its arguments.

The following path elements can be used:

- **close**: Closes the current figure by adding a straight line from the current point to the start point.
- **move x y**: Closes the current figure and starts a new one at \((x, y)\).
- **line x y**: Adds a straight line to the current figure, from the current point to \((x, y)\) and makes \((x, y)\) be the current point.
- **arc x y width height start-angle sweep optional movep**: Adds an elliptical arc to the current figure, contained in the rectangle from \((x, y)\) to \((x+width, y+width)\) from start-angle to start-angle+sweep-angle. Both angles are specified in radians and positive values mean anti-clockwise. If movep is \texttt{nil} (the default), then a straight line is also added from the current point to the start of the arc, otherwise a new figure is started from the start of the arc. The end of the arc becomes the new current point.
- **bezier cx1 cy1 cx2 cy2 x y**: Adds a cubic Bézier curve to the current figure, from the current point to \((x, y)\) using control points \((cx1, cy1)\) and \((cx2, cy2)\).
- **rectangle x y width height**: Adds a self contained figure, a rectangle from \((x, y)\) to \((x+width, y+width)\).
:ellipse  x  y  x-radius  y-radius
   Adds a self contained figure, an ellipse of the given radii centered on (x y).

:scale  sx  sy  elements
   Adds the path elements elements, scaling them by sx and sy.

:rotate  theta  elements
   Adds the path elements elements, rotating them theta radians about the origin. If theta is positive, then the rotation is clockwise.

:translate  dx  dy  elements
   Adds the path elements elements, translating them by dx and dy.

:transform  transform  elements
   Adds the path elements elements, transformed by transform.

Examples
Draws two lines from (40 30) to (140 30) and from (140 30) to (140 130):

(draw-path port '((:line 100 0) (:line 100 100)) 40 30)

Draws an outline triangle with vertices (40 30), (140 30) and (140 130):

(draw-path port '((:line 100 0) (:line 100 100)) 40 30 :closed t)

Draws a filled triangle with vertices (40 30), (140 30) and (140 130):

(draw-path port '((:line 100 0) (:line 100 100)) 40 30 :filled t)

Draws a filled triangle exactly as in the previous example but using a function to generate the path elements:
(flet ((generate (fn)
            (funcall fn :line 100 0)
            (funcall fn :line 100 100)))
        (draw-path port #'generate 40 30 :filled t))

Draws 6 copies of a shape consisting of two lines and an arc:

(labels ((generate-1 (fn)
                (funcall fn :line 50 0)
                (funcall fn :line 50 50)
                (funcall fn :arc 0 -50 100 100
                           (/ pi -2) (/ pi -2)))
           (generate-6 (fn)
                        (dotimes (x 6)
                                  (funcall fn :rotate (* 2 pi (/ x 6))
                                                  #'generate-1)))))
        (draw-path port #'generate-6 80 80))

There are more examples in

(example-edit-file "capi/graphics/paths")

There are further examples in Chapter 20, “Self-contained examples”.

See also
draw-polygon
draw-line
draw-arc
draw-ellipse
graphics-state
Chapter 13, “Drawing - Graphics Ports”

draw-point  

Function

Summary  
Draws a pixel or unit square at a given point.

Package      graphics-ports

Signature     draw-point port x y &rest args

Arguments     port  A graphics port.
x  A real number.
y  A real number.
args  graphics-state parameters passed as keyword arguments.

Description
The function draw-point draws a single-pixel point at (x y). The transform, foreground, background, operation, mask, pattern, shape-mode and compositing-mode graphics-state parameters are used. Additionally on X11/Motif only, stipple is used.

When drawing-mode is :compatible the output is a single pixel. Note that its position is transformed in the normal way.

When drawing-mode is :quality this draws a unit square as if by draw-rectangle, transformed in the normal way.

See also
draw-points
graphics-state

draw-points

Summary
Draws pixels or unit squares at given points.

Package
graphics-ports

Signature
draw-points port description &rest args

Arguments
port  A graphics port.
description  A description sequence.
args  graphics-state parameters passed as keyword arguments.
The function `draw-points` draws several points (as if by `draw-point`) as specified by the `description` argument, which is a sequence of $x$ $y$ pairs. It is usually faster than several calls to `draw-point`. See `draw-point` for more information.

See also `draw-point`
fill-rule specifies how overlapping regions are filled. Possible values are :even-odd and :winding.

See also
draw-polygons
graphics-state
Chapter 13, “Drawing - Graphics Ports”

draw-polygons

Function

Summary
Draws several polygons.

Package
graphics-ports

Signature
draw-polygons port description &rest args &key filled closed fill-rule

Arguments
port A graphics port.
description A sequence of sequences of real numbers.
filled A boolean.
closed A boolean.
fill-rule A keyword.
args graphics-state parameters passed as keyword arguments.

Description
The function draw-polygons draws several polygons. The description argument should be a sequence containing sequences with alternating x and y values representing the vertices. The description arguments consists of groups of points as in draw-polygon.

When closed is true the edge from the last vertex to the first to be drawn.

When filled is true a filled, closed polygons are drawn; the closed argument is ignored if filled is true.
transform, foreground, background, operation, thickness, scale-thickness, dashed, dash, line-end-style, line-joint-style, mask, pattern, shape-mode and compositing-mode from the port’s graphics-state are all used, unless overridden in args. Additionally on X11/Motif only, stipple is used.

fill-rule specifies how overlapping regions are filled. Possible values are :even-odd and :winding.

Example
This draws two hexagons, one inside the other:

```lisp
(gp:draw-polygons oo
 `(((150 100 200 100 235 150 200
      200 150 200 115 150)
    (140 90 210 90 250 150
     210 210 140 210 100 150))
   :closed t))
```

See also
draw-polygon
graphics-state
Chapter 13, “Drawing - Graphics Ports”

draw-rectangle

Function

Summary
Draws a rectangle.

Package
graphics-ports

Signature
draw-rectangle port x y width height &rest args &key filled

Arguments
port A graphics port.

x A real number.

y A real number.

width A real number.

height A real number.

filled A boolean.
Description

The function `draw-rectangle` draws a rectangle whose corners are \((x, y), (x+\text{width}, y), (x+\text{width}, y+\text{height})\) and \((x, y+\text{height})\). `filled`, if non-nil, causes a filled rectangle to be drawn. While the exact results are host-specific, it is intended that a filled rectangle does not include the lines \((x = x+\text{width})\) and \((y = y+\text{height})\) while a non-filled rectangle does. This function works correctly if the port’s transform includes rotation.

The `graphics-state` parameters `transform`, `foreground`, `background`, `operation`, `thickness`, `scale-thickness`, `dashed`, `dash`, `line-joint-style`, `mask`, `pattern`, `shape-mode` and `compositing-mode` are used. Additionally on X11/Motif only, `stipple` is used.

See also `draw-rectangles` `graphics-state` Chapter 13, “Drawing - Graphics Ports”

draw-rectangles

Function

Summary

Draws several rectangles.

Package `graphics-ports`

Signature

draw-rectangles port description &rest args &key filled

Arguments

`port` A graphics port.
`description` A description sequence.
`filled` A boolean.
`args` `graphics-state` parameters passed as keyword arguments.
The function `draw-rectangles` draws several rectangles as specified in `description` which consists of a group of values given as `x y width height`.

`filled`, if true, causes filled rectangles to be drawn. While the exact results are host-specific, it is intended that a filled rectangle does not include the lines `(x = x+width)` and `(y = y+height)` while a non-filled rectangle does. This function works correctly if the port's transform includes rotation.

The `graphics-state` parameters `transform`, `foreground`, `background`, `operation`, `thickness`, `scale-thickness`, `dashed`, `dash`, `line-joint-style`, `mask`, `pattern`, `shape-mode` and `compositing-mode` are used. Additionally on X11/Motif only, `stipple` is used.

See also

- `draw-rectangle`
- `graphics-state`

Chapter 13, “Drawing - Graphics Ports”

**draw-string**

*Function*

**Summary**

Draws a string with the baseline positioned at a given point.

**Package**

`graphics-ports`

**Signature**

`draw-string port string x y &rest args &key start end block`

**Arguments**

- `port` A graphics port.
- `string` A string.
- `x` A real number.
- `y` A real number.
- `start` A real number.
- `end` A real number.
- `block` A boolean.
The function `draw-string` draws the string `string` with the baseline starting at `(x y)`. The `transform`, `foreground`, `background`, `operation`, `stipple`, `pattern`, `mask`, `mask-transform`, `font`, `text-mode` and `compositing-mode` from port’s `graphics-state` are all used, unless overridden in `args`.

`start` and `end` specify which elements of the `string` to draw. The default value of `start` is 0.

`block`, if true, causes each character to be drawn in a character cell filled with the `background` of port’s `graphics-state`.

You can draw with the system highlight by setting `graphics-state` parameter `foreground :color_highlighttext` and `background :color_highlight`.

The `graphics-state` parameter `operation` is not supported for drawing text on Microsoft Windows.

```
(let ((op (capi:contain
  (make-instance 'capi:output-pane
    :background :red)))
  (gp:draw-string op "highlighted"
    10 10
    :graphics-args
    (list :foreground
      :color_highlighttext)))
```

### See also

- `graphics-state`
- Chapter 13, “Drawing - Graphics Ports”

---

**ensure-gdiplus**

**Function**

**Summary**

Ensures GDI+ is present and running, or shuts it down. Needed only when writing FLI graphics code on Windows.
Package graphics-ports

Signature ensure-gdiplus &key event-func force shutdown => result

Arguments

- event-func A function, or nil.
- force A boolean.
- shutdown A boolean.

Values result A boolean.

Description The function ensure-gdiplus checks that the GDI+ module gdiplus.dll is loaded and that GdiplusStartup has been called, or shuts down GDI+.

Most users will not need to call ensure-gdiplus. This is because when LispWorks itself uses GDI+, for instance via read-external-image, it calls ensure-gdiplus automatically, and never shuts GDI+ down.

However, if your code uses GDI+ directly (by calling it through the Foreign Language Interface), then you should call ensure-gdiplus instead of using GdiplusStartup directly. Then, LispWorks will know that GDI+ has already started. This is the only circumstance in which you need to call ensure-gdiplus.

Note: ensure-gdiplus is implemented only in LispWorks for Windows.

If shutdown is nil, ensure-gdiplus ensures GDI+ is started, by the following steps:

1. Load the GDI+ module gdiplus.dll, if it is not already loaded.
2. If
   a) GDI+ was already started by a previous call to ensure-gdiplus, and
b) force is \texttt{nil}, and
c) \texttt{event-func} was either not passed or is \texttt{cl:eq} to the
value that was passed for point a)
then \texttt{ensure-gdiplus} simply returns \texttt{nil}.

3. If GDI+ was already started, shut it down.

4. Start GDI+, and return the result of \texttt{GdiplusStartup}.
   This is 0 for success. For he meaning of other values, see
the documentation of \texttt{gpStatus} in the MSDN.

If \texttt{shutdown} is true, then if GDI+ was started \texttt{ensure-gdiplus}
shuts it down, and returns \texttt{t}, otherwise \texttt{ensure-gdiplus}
returns \texttt{nil}. The default value of \texttt{shutdown} is \texttt{nil}.

The default value of both \texttt{event-func} and \texttt{force} is \texttt{nil}.

See also \texttt{read-external-image}

\textbf{external-image} \hspace{1cm} \textit{Class}

\textbf{Summary} \hspace{1cm} A class representing a color image.

\textbf{Package} \hspace{1cm} graphics-ports

\textbf{Description} \hspace{1cm} The class \texttt{external-image} provides a representation of a
color image that is subject to \texttt{write-external-image}, \texttt{read-
external-image} and \texttt{convert-external-image} operations.

See also \texttt{convert-external-image}
\texttt{read-external-image}
\texttt{write-external-image}

Chapter 13, “Drawing - Graphics Ports”
### external-image-color-table

**Function**

| Summary | Returns a vector containing RGB color specifications of an external image. |
| Package | graphics-ports |
| Signature | `external-image-color-table external-image => color-table` |
| Arguments | `external-image` An external image. |
| Values | `color-table` A color table. |
| Description | The function `external-image-color-table` returns a vector containing RGB color specifications representing the color table as specified in the external image. If the result is `nil`, the external image is a 24-bit DIB, with the colors defined in each pixel instead of through a table. |

### external-image-color-table

**Setf Expander**

| Summary | Replaces the color table in an external image. |
| Package | graphics-ports |
| Signature | `(setf external-image-color-table) replacement-color-table external-image` |
| Arguments | `external-image` An external image. `replacement-color-table` A color table. |
Description

(setf external-image-color-table) replaces the color table in external-image. The color table specified by replacement-color-table must be the same length as the external image’s original color table. It is a vector of RGB color specifications.

**externalize-and-write-image**

**Function**

**Summary**

Externalizes and writes an image to file.

**Package**

graphics-ports

**Signature**

externalize-and-write-image gp image filename &key type if-exists errorp x-hot y-hot quality &allow-other-keys => result

**Arguments**

*gp* A CAPI pane.

*image* An image object.

*filename* A file namestring or a pathname.

*type* One of the keywords :bmp, :jpg, :jpeg, :png and :tiff. Other keywords may be supported, depending on the platform.


*errorp* A boolean.

*x-hot* A non-negative integer.

*y-hot* A non-negative integer.

*quality* An integer in the range [0,100].

**Values**

*result* A filename or nil.
The function \texttt{externalize-and-write-image} externalizes and writes an \texttt{image} object to file.

The output image type can be specified by the argument \texttt{type}. If \texttt{type} is not supplied then the output image type is determined by the file type in the \texttt{filename}.

If \texttt{type} is supplied, it must be a keyword which specifies a known type, as returned by \texttt{list-known-image-formats} with \texttt{for-writing-too} \texttt{t}. The types \texttt{:bmp, :jpg, :png} and \texttt{:tiff} are known on all platforms (except Motif). Additionally, \texttt{:jpeg} is an alias for \texttt{:jpg}.

If \texttt{type} is not supplied, then the file extension of the \texttt{filename} is used to "guess" the type. In general it is the extension uppercased and interned in the keyword package. It also recognizes some special cases:

<table>
<thead>
<tr>
<th>File extension</th>
<th>Image type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;TIF&quot;</td>
<td>:tiff</td>
</tr>
<tr>
<td>&quot;DIB&quot;</td>
<td>:bmp</td>
</tr>
<tr>
<td>&quot;JPE&quot;</td>
<td>:jpg</td>
</tr>
<tr>
<td>&quot;JPEG&quot;</td>
<td>:jpg</td>
</tr>
<tr>
<td>&quot;JFIF&quot;</td>
<td>:jpg</td>
</tr>
<tr>
<td>&quot;JP2&quot;</td>
<td>:jpg2000</td>
</tr>
</tbody>
</table>

Table 22.1 Image type from file extension: special cases

\textbf{Note:} Image type \texttt{:jpg2000} is implemented on Cocoa only.

\texttt{errorp} controls what happens if \texttt{externalize-and-write-image} does not recognize the type. If \texttt{errorp} is non-nil, it calls \texttt{error}, otherwise it returns \texttt{nil}. The default value of \texttt{errorp} is \texttt{t}. 

1069
if-exists controls what to do if the filename already exists, in the same way as the if-exists argument to open. However, unlike open, the default value of if-exists is :supersede.

x-hot and y-hot are used only when generating a CUR file, which is currently implemented on GTK+ only. They specify the hotspot coordinates when the image is used as a cursor (in a LispWorks application by load-cursor and (setf capi:simple-pane-cursor), or in other applications). Their values must be integers within the width/height of the image. The default value of both x-hot and y-hot is 0.

quality is used for writing a JPG image on GTK+. It must be an integer in the inclusive range [0,100]. High values generate better images and larger files.

result is filename on success, or nil for an unknown type when errorp is nil. It signals an error in other cases (for example, failure to open the file because of permissions).

Examples

There is a simple example in:

(example-edit-file "capi/graphics/images-with-alpha")

See also

list-known-image-formats

Chapter 13, “Drawing - Graphics Ports”

externalize-image

Function

Summary

Returns an external image containing color information from an image.

Package

graphics-ports

Signature

externalize-image gp image &key maximum-colors
  important-colors &allow-other-keys
=> external-image

Arguments

gp A CAPI pane.
The function `externalize-image` returns an `external-image` containing color information from `image`.

If `maximum-colors` is `nil` or if the screen has no palette, an `external-image` using all the colors in `image` is created.

If `maximum-colors` is an integer, the `external-image` containing image will be created using no more than that number of colors. If the image contains more than `maximum-colors` colors, the `maximum-colors` most frequently used colors will be accurately stored; the remainder will be approximated by nearest colors out of the accurate ones, using internal Color System parameters as the weighting factors for the color distance.

The value of `important-color` is recorded in the `external-image` for later use, and specifies the number of colors required to draw a good likeness of the image. The default value is the number of colors in the image.

See also

- `make-image-from-port`
- `write-external-image`
- Chapter 13, “Drawing - Graphics Ports”

---

**f2pi**

**Constant**

**Summary**

\((* 2 \pi)\) as a `single-float`.

**Package**

`graphics-ports`
The constant \texttt{f2pi} is the result of \texttt{(float (* 2.0 cl:pi) 1.0)}. It is a \texttt{cl:single-float}.

See also \texttt{fpi} \texttt{fpi-by-2}

\textbf{find-best-font} \hfill \textit{Function}

\textbf{Summary} \hfill Returns the best font for a CAPI pane.

\textbf{Package} \hfill \texttt{graphics-ports}

\textbf{Signature} \hfill \texttt{find-best-font pane fdesc => font}

\textbf{Arguments} \hfill \begin{itemize} \item \texttt{pane} \hfill A graphic port. \item \texttt{fdesc} \hfill A font description. \end{itemize}

\textbf{Values} \hfill \texttt{font} \hfill A font.

\textbf{Description} \hfill The function \texttt{find-best-font} returns the best font for \texttt{pane} which matches \texttt{fdesc}. When there alternative fonts available the choice of best font is operating system dependent. When \texttt{fdesc} contains the attribute \texttt{:stock} with value \texttt{:system-font} or \texttt{:system-fixed-font}, the lookup will always find a stock font. By default \texttt{find-best-font} looks only for Truetype fonts in LispWorks 6.1 and later.

\textbf{Notes} \hfill With the default \texttt{drawing-mode :quality} only Truetype fonts are supported. Non-Truetype fonts are supported only when using \texttt{drawing-mode :compatible}.

\textbf{Compatibility note} \hfill To get the LispWorks 6.0 behavior where non-Truetype fonts are also found, pass \texttt{:type :wild} to \texttt{make-font-description}. 

1072
find-matching-fonts

Summary
Returns a list of the font objects available for a pane.

Package
graphics-ports

Signature
find-matching-fonts pane fdesc => fonts

Arguments
pane A CAPI pane.
fdesc A font description.

Values
fonts A list of fonts.

Description
The function find-matching-fonts returns a list of the font objects available for pane which match the attributes in fdesc. nil is returned if none match.

When fdesc contains the attribute :stock with value :system-font or :system-fixed-font, the lookup will always find a stock font.

find-matching-fonts behaves as if the :family, :weight, :slant and :size attributes have value :wild if they are missing from fdesc.

See also
find-best-font
list-all-font-names
make-font-description
Chapter 13, “Drawing - Graphics Ports”
font

Summary
An object corresponding to a font in the native system.

Description
font objects are returned by find-best-font and find-matching-fonts.

font objects are used to specify fonts for drawing, either in the graphics-state of the port or in the drawing functions themselves. font objects can also be used for querying the actual attributes of the font (ascent, descent and so on) and the dimensions of character and strings.

Notes
font objects are not externalizable objects.

See also
font-description
find-best-font
find-matching-fonts
graphics-state
get-font-ascent
get-font-descent
get-font-width
get-font-height
get-font-average-width
get-char-width
get-char-ascent
get-char-descent
get-character-extent
get-string-extent
compute-char-extents
font-single-width-p
font-fixed-width-p
font-description
**font-description**

**Type**

**Summary**
An object used in CAPI to describe a font.

**Description**
Objects of type `font-description` contain a description of a font. The description can be partial, with only some attributes given values. `font-description` objects are the normal way of specifying fonts in CAPI.

`font-description` objects are created or returned by `make-font-description`, `convert-to-font-description`, `font-description`, `merge-font-descriptions` and `augment-font-description`.

`font-description` objects are used as the font specification for CAPI panes (see `simple-pane`). They can also be used directly in calls to `find-best-font` and `find-matching-fonts`.

**Notes**
1. `font-description` objects do not contain native system dependent values, and are externalizable objects.

2. A `font-description` cannot be used directly as an argument to `draw-string` or `draw-character`, or as the value of the graphics state parameter `font` in a `graphics-state`. These require the result of `find-best-font` or `find-matching-fonts`.

**See also**
`make-font-description`
`convert-to-font-description`
`font-description`
`merge-font-descriptions`
`augment-font-description`
`font-description-attributes`

Chapter 3, “General Properties of CAPI Panes”
font-description

Summary
Returns a font description object for a given font.

Package
graphics-ports

Signature
font-description font => fdesc

Arguments
font
A font.

Values
fdesc
A font description.

Description
The function font-description returns a font description object for font. Using this font description in a later call to find-matching-fonts or find-best-font on the original pane is expected to return a similar font.

See also
convert-to-font-description
make-font-description

font-description-attribute-value

Summary
Returns the values of a given font attribute in a font description.

Package
graphics-ports

Signature
font-description-attribute-value fdesc font-attribute => value

Arguments
fdesc
A font description.
font-attribute
A font attribute.

Values
value
A font attribute value.
The function `font-description-attribute-value` returns the value of `font-attribute` in `fdesc`, or `:wild` if `font-attribute` is not specified in `fdesc`.

See also `font-description-attributes`

---

**font-description-attributes**

*Function*

Summary

Returns the attributes of a given font description.

Package

`graphics-ports`

Signature

`font-description-attributes fdesc => font-attributes`

Arguments

`fdesc` A font description.

Values

`font-attributes` A list of font attributes.

Description

The function `font-description-attributes` returns the attributes of the `fdesc`. The list should not be destructively modified.

See also `font-description-attribute-value`

---

**font-dual-width-p**

*Function*

Summary

The predicate for dual-width fonts. This function is deprecated.

Signature

`font-dual-width-p port &optional font => result`

Arguments

`port` A graphics port.

`font` A `font` or a `font-description` object.
font-fixed-width-p

Function

Summary The predicate for fixed-width fonts.

Package graphics-ports

Signature font-fixed-width-p port &optional font => result

Arguments port A graphics port.

font A font or a font-description object.

Values result A boolean.

Description The function font-fixed-width-p returns t if the optionally specified font, or otherwise the font associated with port, is fixed-width.

fixed-width is not exactly the same as single-width. A fixed-width font with double width characters is dual-width; other fixed-width fonts are single-width.

Notes editor-pane supports variable width fonts on Microsoft Windows, GTK+ and Motif.

See also font-description
Function

**font-single-width-p**

**Summary**
The predicate for single-width fonts. This function is deprecated.

**Signature**
`font-single-width-p port &optional font => result`

**Arguments**
`font` A font or a font-description object.

**Values**
`result` A boolean.

**Description**
The function `font-single-width-p` returns t when all characters in the font specified by `font` are of the same width. A single-width font is fixed-width.

**See also**
- `font-fixed-width-p`
- `font-description`

---

**fpi**

**Constant**

**Summary**
pi as a single-float.

**Package**
`graphics-ports`

**Description**
The constant `fpi` is the result of `(float cl:pi 1.0)`. It is a `cl:single-float`.

**See also**
- `2pi`
- `f2pi`
- `fpi-by-2`

---

**fpi-by-2**

**Constant**

**Summary**
`(/ pi 2)` as a single-float
Package graphics-ports

Description The constant \texttt{fpi-by-2} is the result of \texttt{(float (* 0.5 cl:pi) 1.0)}. It is a \texttt{cl:single-float}

See also \texttt{fpi} \texttt{f2pi}

\begin{description}
  \item \texttt{free-image} \hfill \textit{Function}
  \item Summary Frees the library resources allocated with an image.
  \item Package graphics-ports
  \item Signature \texttt{free-image port image}
  \item Arguments \begin{itemize}
  \item \texttt{port} A CAPI pane.
  \item \texttt{image} An image.
  \end{itemize}
  \item Description The function \texttt{free-image} frees the library resources associated with \texttt{image}. This should be done when an image is no longer needed.
  \item See also Chapter 13, “Drawing - Graphics Ports” Chapter 17, “Drag and Drop”
\end{description}

\begin{description}
  \item \texttt{free-image-access} \hfill \textit{Function}
  \item Summary Frees an Image Access object.
  \item Package graphics-ports
  \item Signature \texttt{free-image-access image-access}
  \item Arguments \begin{itemize}
  \item \texttt{image-access} An Image Access object
  \end{itemize}
\end{description}
The function free-image-access discards image-access, which should be an Image Access object returned by make-image-access.

See also
- image-access-transfer-from-image
- image-access-transfer-to-image
- image-access-pixel
- make-image-access
- “Image access” on page 224

get-bounds

Function

Summary
Returns the four values of the currently collected drawing extremes.

Package
graphics-ports

Signature
get-bounds pixmap-port => left, top, right, bottom

Arguments
- pixmap-port A graphics port.

Values
- left An integer.
- top An integer.
- right An integer.
- bottom An integer.

Description
The function get-bounds returns the four values left, top, right, bottom of the currently collected drawing extremes. The values can be used to get an image from the port.

Drawing extremes are collected by passing non-nil for the collect or relative arguments to create-pixmap-port or with-pixmap-graphics-port.
Example

(with-pixmap-graphics-port (pl pane width height
  :relative t))
(with-graphics-rotation (pl 0.123))
(draw-rectangle pl 100 100 200 120 :filled t
  :foreground :red)
(get-bounds pl))

produces the following output:

72
112
285
255

See also
create-pixmap-port
make-image-from-port
with-pixmap-graphics-port

get-char-ascent

Function

Summary
Returns the ascent of a character in pixels.

Package
graphics-ports

Signature
get-char-ascent port character font => ascent

Arguments
port
A CAPI pane.

character
A character.

font
A font.

Values
ascent
An integer.

Description
The function get-character-ascent returns the ascent in pixels of the character in the font associated with port, or the font given.
**get-char-descent**

*Function*

**Summary**
Returns the descent of a character in pixels.

**Package**
graphics-ports

**Signature**
get-char-descent port character font => descent

**Arguments**
- *port* A CAPI pane.
- *character* A character.
- *font* A font.

**Values**
- *descent* An integer.

**Description**
The function `get-char-descent` returns the descent in pixels of the character in the font associated with *port*, or the *font* given.

**get-char-width**

*Function*

**Summary**
Returns the width of a character in pixels.

**Package**
graphics-ports

**Signature**
get-char-width port character font => width

**Arguments**
- *port* A CAPI pane.
- *character* A character.
- *font* A font.

**Values**
- *width* An integer.

**Description**
The function `get-char-width` returns the width in pixels of the character in the font associated with *port*, or the *font* given.
get-character-extent

Function

Summary
Returns the extent of a character in pixels.

Package
graphics-ports

Signature
get-character-extent port character &optional font => left, top, right, bottom

Arguments
port A CAPI pane.
character A character.
font A font.

Values
left An integer.
top An integer.
right An integer.
bottom An integer.

Description
The function get-character-extent returns the extent in pixels of the character in the font associated with port, or the font given.

get-enclosing-rectangle

Function

Summary
Returns the smallest rectangle enclosing the given points.

Package
graphics-ports

Signature
get-enclosing-rectangle &rest points => left, top, right, bottom

Arguments
points Real numbers.

Values
left A real number.
A real number.
A real number.
A real number.

Description
The function get-enclosing-rectangle returns four values, describing the rectangle which exactly encloses the input points. The points argument must be a (possibly empty) list of alternating x and y values. If no points are given the function returns the null (unspecified) rectangle, which is four nils.

get-font-ascent

Summary
Returns the ascent of a font.

Package graphics-ports

Signature get-font-ascent port &optional font => ascent

Arguments
port A CAPI pane.
font A font.

Values
ascent An integer.

Description
The function get-font-ascent returns the ascent in pixels of the font associated with port, or the font given.

get-font-average-width

Summary
Returns the average width of a font in pixels.

Package graphics-ports

Signature get-font-average-width port &optional font => average-width
Arguments

- **port**: A CAPI pane.
- **font**: A font.

Values

- **average-width**: An integer.

Description

The function `get-font-average-width` returns the `average-width` in pixels of the font associated with `port`, or the `font` given.

See also

Chapter 13, “Drawing - Graphics Ports”

---

**get-font-descent**

Function

Summary

Returns the descent in pixels of a font.

Package

graphics-ports

Signature

`get-font-descent port &optional font => descent`

Arguments

- **port**: A CAPI pane.
- **font**: A font.

Values

- **descent**: An integer.

Description

The function `get-font-descent` returns the `descent` in pixels of the font associated with `port`, or the `font` given.

---

**get-font-height**

Function

Summary

Returns the height of a font.

Package

graphics-ports

Signature

`get-font-height port &optional font => height`
Arguments

- **port**: A CAPI pane.
- **font**: A font.

Values

- **height**: An integer.

Description

The function `get-font-height` returns the `height` in pixels of the font associated with `port`, or the `font` given.

See also

- Chapter 13, “Drawing - Graphics Ports”

---

**get-font-width**

*Function*

Summary

Returns the width of a font.

Package

**graphics-ports**

Signature

`get-font-width port &optional font => width`

Arguments

- **port**: A graphics port.
- **font**: A font.

Values

- **width**: An integer.

Description

The function `get-font-width` returns the `width` in pixels of the font associated with `port`, or the `font` given.

See also

- Chapter 13, “Drawing - Graphics Ports”

---

**get-graphics-state**

*Function*

Summary

Returns the `graphics-state` object for a graphics port. `get-graphics-state` is deprecated. Use `port-graphics-state` instead.
Package:  graphics-ports

Signature:  get-graphics-state  port => state

Arguments:  port  A graphics port.

Values:  state  A graphics-state object.

Description:  get-graphics-state is deprecated. Use port-graphics-state instead.

See also:  port-graphics-state

get-origin

Function

Summary:  Returns the coordinate origin of a pixmap graphics port.

Package:  graphics-ports

Signature:  get-origin  pixmap-port => x, y

Arguments:  pixmap-port  A graphics port.

Values:  x  An integer.
         y  An integer.

Description:  This returns two values being the coordinate origin of the pixmap graphics port. Normally this is (0 0) but after a series of drawing function calls with :relative t, the drawing may have been shifted. The values returned by get-origin tell you by how much. The values are not needed when making images from the port’s drawing.
Example
(with-pixmap-graphics-port (p1 pane width height :relative t)
  (with-graphics-rotation (p1 0.123)
    (draw-rectangle p1 0 0 200 120 :filled t
     :foreground :red)
    (get-origin p1)))

produces:

-15
0

get-string-extent

Function

Returns the extent in pixels of a string.

Summary

Returns the extent in pixels of a string.

Package

graphics-ports

Signature

get-string-extent port string &optional font => left, top, right, bottom

Arguments

port A CAPI pane.
string A string.

Values

left An integer.
top An integer.
right An integer.
bottom An integer.

Description

The function get-string-extent returns the extent in pixels of the string in the font associated with port, or the font given.

Note: To compute the horizontal extents of each successive character in a string for a given port or font, use compute-char-extents.

See also

compute-char-extents
get-transform-scale

Function

Summary
Returns the overall scaling factor of a transform.

Package
graphics-ports

Signature
get-transform-scale transform => result

Arguments
transform A transform object.

Values
result A real number.

Description
The function get-transform-scale returns a single number representing the overall scaling factor present in the transform.

Notes
See graphics-state for details of how a transform is used.

See also
graphics-state
transform

graphics-port-background

Function

Summary
Accesses the background, font, foreground or transform in the graphics state of a graphics port.

Package
graphics-ports

Signature
graphics-port-background port => color-spec
graphics-port-font port => font
graphics-port-foreground port => color-spec
graphics-port-transform port => transform

(setf graphics-port-background) color-spec port => color-spec
(setf graphics-port-font) font port => font
(setf graphics-port-foreground) color-spec port => color-spec
(setf graphics-port-transform) transform port => transform

Arguments

port A graphics port.

Values

color-spec A color specification, or nil.

font A font object, or nil.

transform A transform object.

Description

The functions graphics-port-background, graphics-port-font, graphics-port-foreground and graphics-port-transform access the background, font, foreground or transform in the graphics-state associated with port. This can be used to set the value by setf.

See the graphics-state entry for the types and acceptable values of the various slots, and information about how they are used.

See also

graphics-state
port-graphics-state
set-graphics-state
transform
with-graphics-state

graphics-port-mixin

Summary

An abstract class supporting Graphics Ports operations.

Package

graphics-ports
Subclasses

output-pane
pixmap-port
printer-port
metafile-port

Description
The class `graphics-port-mixin` is an abstract class for supporting graphics ports operations. All the classes that support drawing (generally referred to as "graphics ports") inherit from it.

See also
Chapter 13, “Drawing - Graphics Ports”

---

graphics-state

Structure Class

Summary
The graphics state object, holding default parameters for drawing operations on an associated `port`.

Package
graphics-ports

Slots

 transform
A `transform` object which determines the coordinate transformation applying to the graphics port. The default value is the unit transform which leaves the port coordinates unchanged from those used by the host window system — origin at top left, X increasing to the right and Y increasing down the screen. Allowed values are anything returned by the transform functions, described in “Graphics state transforms” on page 213.

 foreground
Determines the foreground color used in drawing functions. The value can be a converted color (result of `convert-color`), a color name symbol, a color name string or a color spec object. Using converted colors
results in better performance, because it saves the system from doing the conversion each time it uses it. The default value is :black. The value :color_highlighttext is useful for drawing text with the system highlighting.

**background**

Determines the background color used in functions which draw text such as draw-string when block is true.

On X11/Motif, background also determines the background color used in drawing functions which use a stipple.

Valid values are the same as for foreground. The default value is :white. The value :color_highlight is useful for drawing text with the system highlighting.

**operation**

Determines the color combination used in the drawing primitives when the port’s drawing-mode is :compatible. Valid values are 0 to 15, being the same logical values as the op arg to the Common Lisp function boole. The default value is boole-1. “Combining pixels with :compatible drawing” on page 215 shows how to use operation.

**stipple**

On X11/Motif stipple is a 1-bit pixmap (“bitmap”) or nil (which is the default value). The bitmap is used in conjunction with the fill-style when drawing. Here, nil means that all pixels are drawn in the foreground color. A stipple is not transformed by the transform parameter. Its origin is assumed to coincide with the origin of the port. The stipple is tiled across the drawing. stipple is ignored if a pattern is given. If no fill-style is
given, or it is specified as :solid, when a stipple is given, then fill-style defaults to :opaque-stippled.

fill-style

Determines how the drawing is done. The value should be one of :solid, :tiled, :opaque-stippled or :stippled. The default value :solid means that the foreground is used everywhere. :tiled means that the pattern is repeated over across the drawing.

Additionally on X11/Motif :opaque-stippled means that the stipple bitmap is used with stipple 1s giving the foreground and 0s the background. :stippled means that the stipple bitmap is used with foreground where there are 1s and where the are 0s, no drawing is done. If you specify a stipple but no fill-style, or a fill-style of :solid, it defaults to :opaque-stippled.

pattern

An image the same depth as the port, or nil. If non-nil, pattern is used as the source of color for drawing instead of the foreground and background parameters. A pattern is not transformed by the transform parameter. The pattern is tiled across the drawing. When pattern is specified, the stipple value is ignored. The default value of pattern is nil.

See “Working with images” on page 219 for information on creating an image.

thickness

A number (defaulting to 1) specifying the thickness of lines drawn. If scale-thickness is non-nil, the value thickness is in port (transformed) coordinates, otherwise thickness is in pixels.
scale-thickness  A boolean, defaulting to \texttt{t} which means interpret the \texttt{thickness} parameter in transformed port coordinates. If \texttt{scale-thickness} is \texttt{nil}, \texttt{thickness} is interpreted in pixels.

dashed  A boolean, defaulting to \texttt{nil}. If \texttt{dashed} is \texttt{t} then lines are drawn as a dashed line using \texttt{dash} as the mark-space specifier.

dash  A list of two or more integer, or \texttt{nil}. A list of integers specifies the alternate mark and space sizes for dashed lines. These mark and space values are interpreted in pixels only. The default value of \texttt{dash} is \texttt{(4 4)}.

line-end-style  The value should be one of \texttt{:butt}, \texttt{:round} or \texttt{:projecting} and specifies how to draw the ends of lines. The default value is \texttt{:butt}.

line-joint-style  The value should be one of \texttt{:bevel}, \texttt{:miter} or \texttt{:round} and specifies how to draw the areas where the edges of polygons meet. The default value is \texttt{:miter}.

mask  \texttt{nil}, or a list specifying a shape. The mask clips the drawing, so that drawing occurs only inside it.

mask-x  An integer specifying in window coordinates where in the port the X coordinate of the mask origin is to be considered to be. The default value is 0.

The \texttt{mask-x} parameter works only when the \texttt{drawing-mode} is \texttt{:compatible} and the platform is GTK+ or X11/Motif.

\texttt{mask-x} is deprecated.
\textit{mask-y} An integer specifying in window coordinates where in the port the Y coordinate of the mask origin is to be considered to be. The default value is 0.

The \textit{mask-y} parameter works only when the \texttt{drawing-mode} is \texttt{compatible} and the platform is GTK+ or X11/Motif.

\textit{mask-y} is deprecated.

\textit{mask-transform} A \texttt{transform} object which determines the coordinate transformation use for the mask in \texttt{drawing-mode} \texttt{quality}.

\textit{font} Either \texttt{nil} or a \texttt{font} object to be used by the \texttt{draw-character} and \texttt{draw-string} functions. The default value is \texttt{nil}.

Note that \textit{font} cannot be a \texttt{font-description}. Use \texttt{find-best-font} to convert a \texttt{font-description} to a \texttt{font}.

\textit{text-mode} A keyword controlling the mode of rendering text, most importantly anti-aliasing.

\textit{shape-mode} A keyword controlling the mode of drawing shapes (that is, anything except text).

\textit{compositing-mode} A keyword controlling the combining of new drawing with existing drawing.
**Accessors**

- `graphics-state-transform`
- `graphics-state-foreground`
- `graphics-state-background`
- `graphics-state-operation`
- `graphics-state-stipple`
- `graphics-state-pattern`
- `graphics-state-thickness`
- `graphics-state-scale-thickness`
- `graphics-state-dashed`
- `graphics-state-dash`
- `graphics-state-fill-style`
- `graphics-state-line-end-style`
- `graphics-state-line-joint-style`
- `graphics-state-mask`
- `graphics-state-mask-x`
- `graphics-state-mask-y`
- `graphics-state-mask-transform`
- `graphics-state-font`
- `graphics-state-text-mode`
- `graphics-state-shape-mode`
- `graphics-state-compositing-mode`

**Description**

Each graphics port has a `graphics-state` object associated with it, providing the default values of graphics parameters for drawing operations. The drawing operations such as `draw-ellipse`, `draw-rectangle` and `draw-string` can override specific parameters by passing them as keyword arguments.

`graphics-state` objects are used in the `with-graphics-state` macro and modified using the accessor functions listed above. See “Setting the graphics state” on page 211 for examples.

`mask` should be `nil` (the default), a list of the form `(x y width height)`, defining a rectangle inside which the drawing is done or a list of the form `(:path path :fill-rule fill-rule)` specifying a path inside which the drawing is done. The mask is not tiled.
In the latter case *path* should be a path specification (see `draw-path`). The *fill-rule* specifies how overlapping regions are filled. Possible values are *even-odd* and *winding*. The *mask* will be transformed by the *mask-transform* parameter.

There some examples of path masks in

```lisp
(example-edit-file "capi/graphics/paths")
```

*mask-transform* is used only in *drawing-mode*:quality. It is ignored in *drawing-mode*:compatible. The default value is the unit transform, which can also be specified as nil. Other allowed values include anything returned by the transform functions, described in “Graphics state transforms” on page 213. The other allowed value of *mask-transform* is the keyword *dynamic* which is replaced by the current value of the *transform* graphics state parameter when the drawing operation uses the mask.

Each of *text-mode* and *shape-mode* can be one of:

- **:plain**  
  No anti-aliasing.

- **:antialias**  
  With anti-aliasing.

- **:fastest**  
  Fastest rendering. The same as *:plain* except on Windows.

- **:best**  
  Best display.

- **:default**  
  The system default (which is *:antialias*).

Additionally *text-mode* can be *compatible*, which causes text to be drawn the way it would be drawn if *drawing-mode* was *compatible*. This makes a difference only on Microsoft Windows, because on other platforms the default *text-mode* draws like the *compatible* one.

The default of both *text-mode* and *shape-mode* is *:default*.

*compositing-mode* is a keyword or an integer controlling the compositing mode, that is the way that a new drawing is combined with the existing value in the target of the drawing to generate the result.
Two values of `compositing-mode` are supported on all platforms other than Motif:

:over  Draw over the existing values. If the source is a solid color, then the result is simply the source. If the source has alpha value $alpha$, then it is blended with the destination, with the destination multiplied by the remainder of the alpha, that is ($1 - alpha$).

:copy  The source is written to the destination ignoring the existing values. If the source has alpha and the target does not, that has the effect of converting semi-transparent source to solid.

The default value of `compositing-mode` is :over.

The value :copy of `compositing-mode` is especially useful for creating a transparent or semi-transparent pixmap-port, which can be displayed directly or converted to an image by `make-image-from-port`.

On Cocoa 10.5 and later and GTK+ 2.8 or later, these additional keyword values of `compositing-mode` are supported: :clear, :over, :in, :out, :atop, :dest-over, :dest-in, :dest-out, :dest-atop, :xor and :add. These correspond to the CAIRO_OPERATOR_* operators in Cairo, which are documented in cairographics.org/operators and the CGBlendMode values which are documented in the CGContext Reference at developer.apple.com.

**Note:** on GTK+, the "unbounded" operators (:in, :out, :dest-in and :dest-atop) do not work properly for shape drawings. They can only be used for image drawing and copying operations.

Both Cocoa and GTK+ also allow `compositing-mode` to be an integer, which is simply passed through to the underlying system. This allows using modes that are not available via keywords, but it is not portable. For Cocoa, it is a CGBlend-
**Mode** as documented in the CGContext Reference. For GTK+ it is `cairo_operator_t`, as documented in the entry for `cairo_t` in the Gnome documentation for Cairo.

**Note:** For drawing images on Cocoa, only values that corresponding to available keywords work properly.

**Notes**

1. *operation* is not supported for drawing text on Microsoft Windows.
2. *stipple* is supported only on X11/Motif.
3. *mask-x* and *mask-y* are supported only on GTK+ and X11/Motif, and only when the *drawing-mode* is :compatible.
4. *pattern* is supported only on Microsoft Windows, GTK+ and X11/Motif.
5. *operation* is not supported by Cocoa/Core Graphics so this slot or argument is ignored on Cocoa.
6. *operation* is ignored when the port’s *drawing-mode* is :quality.
7. *text-mode* and *shape-mode* are supported only on Cocoa, Cairo and GDI+, which are used on Macintosh, GTK and Windows respectively when the *drawing-mode* is :quality. For more information about *drawing-mode*, see “The drawing mode and anti-aliasing” on page 209.

**Examples**

(example-edit-file "capi/graphics/compositing-mode-simple")

(example-edit-file "capi/graphics/compositing-mode")

**See also**

* make-graphics-state
* set-graphics-state
* with-graphics-state

Chapter 13, “Drawing - Graphics Ports”
**image**

Class

Summary
An abstract image object.

Package
graphics-ports

Accessors
image-height  
image-width

Description
The class `image` is the abstract image object class. An image can be drawn using `draw-image`.

`image-height` and `image-width` return the image size in pixels.

Notes
On Cocoa and GTK+ you can drag and drop images. See `set-drop-object-supported-formats` for more information.

See also
convert-external-image  
draw-image  
load-image  
make-image-from-port  
make-sub-image  
read-and-convert-external-image  
Chapter 9, “Adding Toolbars”  
Chapter 13, “Drawing - Graphics Ports”  
Chapter 17, “Drag and Drop”

**image-access-height**  
**image-access-width**

Functions

Summary
Return the dimensions of the underlying image in an Image Access object.

Package
graphics-ports
Signature

image-access-height  image-access => height
image-access-width  image-access => width

Arguments

image-access  An Image Access object

Values

height  An integer.
width  An integer.

Description

The functions image-access-height and image-access-width return the height and width of the underlying image in image-access.

image-access must be an Image Access object returned by make-image-access.

Notes

It is an error to call image-access-height or image-access-width on an Image Access object that has been freed by free-image-access.

Examples

(ex example-edit-file "capi/graphics/image-access")
(ex example-edit-file "capi/graphics/image-access-alpha")

See also

free-image-access
make-image-access

image-access-pixel

Function

Summary

Gets and sets the pixels in an Image Access object.

Package

graphics-ports

Signature

image-access-pixel image-access x y => color-rep
(setf image-access-pixel) color-rep image-access x y => color-rep

Arguments

image-access  An Image Access object
The function `image-access-pixel` returns the converted color at position \(x, y\) in the Image Access object `image-access`.

The converted color `color-rep` is a color representation like that returned by `convert-color`. If needed, `color-rep` can be converted to an RGB value using `unconvert-color`. `color-rep` can contain an alpha value, for images with an alpha channel, and in that case the values are premultiplied.

The function `(setf image-access-pixel)` sets the value of the pixel at position \(x, y\) in the Image Access object `image-access`.

The color rep has to be a converted color, and if the image has alpha it is assumed to be premultiplied.

`image-access` must be an Image Access object returned by `make-image-access`.

If the result of `image-access-pixel` on an image with alpha is used elsewhere (for example drawing a string with the same color), to get the same color you need to un-premultiply it first using `color-from-premultiplied`. When setting the color that came from elsewhere in an image with alpha, you will need to premultiply it using `color-to-premultiplied`. For images without alpha, premultiplication has no effect.

`(example-edit-file "capi/graphics/image-access")`
`(example-edit-file "capi/graphics/image-access-alpha")`

See also `color-from-premultiplied`
`color-to-premultiplied`
`image-access-pixels-from-bgra`
`image-access-pixels-to-bgra`
image-access-transfer-to-image
image-access-transfer-from-image
free-image-access
make-image-access
“Image access” on page 224

image-access-pixels-from-bgra

Function

Summary
Copies a vector of pixel values into an Image Access object.

Package
graphics-ports

Signature
image-access-pixels-from-bgra image-access vector

Arguments
image-access An Image Access object.
vector A vector.

Description
The function image-access-pixels-from-bgra copies all the pixels to the Image Access object image-access from the vector vector. vector should contain a sequence of integer values in the range 0-255 for blue, green, red and alpha of each pixel. This function is optimized for the case where vector has element type (unsigned-byte 8). If the image has alpha, the values in vector are premultiplied.

An error is signalled if vector is not of the correct length for the Image Access object, that is (* 4 width height) where width and height represent the size of image-access.

image-access must be an Image Access object returned by make-image-access.

Notes
1. If you want to use the values in the vector that was filled from an image with alpha in other places, to get the sample color you will need to un-premultiply them,
either by hand (divide the color values by the alpha), or by making a RGB color and using \texttt{color-from-premultiplied}.

2. \texttt{image-access-transfer-to-image} must be called after this function (similarly to \texttt{(setf image-access-pixel)}).

Example

\begin{verbatim}
(example-edit-file "capi/graphics/image-access-bgra")
\end{verbatim}

See also
\begin{itemize}
  \item \texttt{color-from-premultiplied}
  \item \texttt{image-access-pixel}
  \item \texttt{image-access-pixels-to-bgra}
\end{itemize}

\section*{image-access-pixels-to-bgra Function}

\textbf{Summary} \hspace{1cm} Copies pixel values from an Image Access object into a vector.

\textbf{Package} \hspace{1cm} \texttt{graphics-ports}

\textbf{Signature} \hspace{1cm} \texttt{image-access-pixels-to-bgra image-access vector}

\textbf{Arguments} \hspace{1cm} \texttt{image-access} \hspace{0.5cm} An Image Access object.
\hspace{1cm} \texttt{vector} \hspace{0.5cm} A vector.

\textbf{Description} \hspace{1cm} The function \texttt{image-access-pixels-to-bgra} copies all the pixels in the Image Access object \texttt{image-access} into the vector \texttt{vector} as a sequence of integer values in the range 0-255 for the blue, green, red and alpha components of each pixel. This function is optimized for the case where \texttt{vector} has element type \texttt{(unsigned-byte 8)}. If the image has alpha, the values in \texttt{vector} are assumed to be premultiplied.

An error is signalled if \texttt{vector} is not of the correct length for the Image Access object, that is \texttt{(* 4 width height)} where \texttt{width} and \texttt{height} represent the size of \texttt{image-access}. 

1105
image-access must be an Image Access object returned by make-image-access.

Notes

1. When setting values in a vector that is going to be used by image-access-pixels-to-bgra to modify an image with alpha using colors that came from elsewhere, you need to premultiply them either by hand (multiply the color values by the alpha), or using color-to-premultiplied.

2. image-access-transfer-from-image must be called before this function (similarly to image-access-pixel).

Example

(example-edit-file "capi/graphics/image-access-bgra")

See also

color-to-premultiplied
image-access-pixel
image-access-pixels-from-bgra

Function

image-access-transfer-from-image

Summary

Gets the pixel values from an image.

Package

graphics-ports

Signature

image-access-transfer-from-image image-access

Arguments

image-access An Image Access object

Description

The function image-access-transfer-from-image gets the pixel values from an image object, making them accessible via a corresponding Image Access object image-access.

image-access must be an Image Access object returned by make-image-access.
Notionally `image-access-transfer-from-image` transfers the pixel data from the window system into `image-access`, though it might do nothing on platforms where the window system allows direct access to the pixel data.

You can read the pixel data with `image-access-pixel` and `image-access-pixels-to-bgra`.

You can write the pixel data with `(setf image-access-pixel)` and `image-access-pixels-from-bgra`.

Example

```lisp
(example-edit-file "capi/graphics/image-access")
```

See also

- `image-access-transfer-to-image`
- `image-access-pixel`
- `image-access-pixels-from-bgra`
- `image-access-pixels-to-bgra`
- `free-image-access`
- `make-image-access`
- “Image access” on page 224

---

**image-access-transfer-to-image**

**Summary**

Sets the pixel values in an `image`.

**Package**

`graphics-ports`

**Signature**

`image-access-transfer-to-image image-access`

**Arguments**

| `image-access` | An Image Access object |

**Description**

The function `image-access-transfer-to-image` sets the pixel values in an `image` object from the values in a corresponding Image Access object `image-access`.

`image-access` must be an Image Access object returned by `make-image-access`.

---

1107
Notionally **image-access-transfer-to-image** transfers the pixel data from *image-access* to the window system, though it might do nothing on platforms where the window system allows direct access to the pixel data.

Example

```lisp
(example-edit-file "capi/graphics/image-access")
```

See also

- **free-image-access**
- **image-access-transfer-from-image**
- **image-access-pixel**
- **make-image-access**
- “Image access” on page 224

---

**image-freed-p**

*Function*

**Summary**
Determines whether an image has been freed.

**Package**
`graphics-ports`

**Signature**
`image-freed-p image => bool`

**Arguments**

- `image` An image object.

**Values**

- `bool` A boolean.

**Description**
The function **image-freed-p** returns non-nil if the image has been freed, and `nil` otherwise.

---

**image-loader**

*Function*

**Summary**
Returns the image load function.

**Package**
`graphics-ports`

**Signature**
`image-loader image-id &key image-translation-table => loader`
Arguments  
  \textit{image-id}  
  An image identifier.
  
  \textit{image-translation-table}  
  An image translation table.

Values  
  \textit{loader}  
  An image load function.

Description  
The function \texttt{image-loader} returns the image load function that would be called to load the image associated with \textit{image-id} in \textit{image-translation-table}. If the \textit{image-id} is not registered with a load function, the default image load function is returned. The default value of \textit{image-translation-table} is \texttt{*default-image-translation-table*}.

See also  
  \texttt{register-image-load-function}
  \texttt{register-image-translation}

\textbf{image-translation}  

\textit{Function}

Summary  
Returns the translation for an image registered in its image translation table.

Package  
\texttt{graphics-ports}

Signature  
\texttt{image-translation image-id \&key image-translation-table => translation}

Arguments  
  \textit{image-id}  
  An image identifier.
  
  \textit{image-translation-table}  
  An image translation table.

Values  
  \textit{translation}  
  A translation.
The function \texttt{image-translation} returns the translation for \texttt{image-id} registered in \texttt{image-translation-table}. The default value of \texttt{image-translation-table} is \texttt{*default-image-translation-table*}.

\textbf{See also}\n\begin{itemize}
  \item \texttt{register-image-load-function}
  \item \texttt{register-image-translation}
\end{itemize}

#### \texttt{initialize-dithers} \hspace{1cm} \textit{Function}

\textbf{Summary}\nInitialize dither objects up to a given order.

\textbf{Package}\n\texttt{graphics-ports}

\textbf{Signature}\n\texttt{initialize-dithers \&optional order}

\textbf{Arguments}\n\begin{itemize}
  \item \texttt{order} \hspace{1cm} An integer.
\end{itemize}

\textbf{Description}\nThe function \texttt{initialize-dithers} initializes dither objects up to the given \texttt{order} (size = $2^\text{order}$). The default value of \texttt{order} is 3.

\textbf{Notes}\n\texttt{initialize-dither} is deprecated. Dithers do not affect drawing or anti-aliasing.

\textbf{See also}\n\begin{itemize}
  \item \texttt{dither-color-spec}
  \item \texttt{make-dither}
  \item \texttt{with-dither}
\end{itemize}

#### \texttt{inset-rectangle} \hspace{1cm} \textit{Function (inline)}

\textbf{Summary}\nMoves the corners of a rectangle inwards by a given amount.

\textbf{Package}\n\texttt{graphics-ports}
inset-rectangle  rectangle  dx  dy  &optional  dx-right  dy-bottom

Arguments
rectangle  A list of integers.
dx  An integer.
dy  An integer.
dx-right  An integer.
dy-bottom  An integer.

Description
The function inset-rectangle moves the left, top, right and bottom elements of rectangle inwards towards the center by the distances dx, dy, dx-right and dy-bottom respectively.
By default, dx-right is dx, and dy-bottom is dy.

inside-rectangle

Summary
Determines if a point lies inside a rectangle.

Package
graphics-ports

Signature
inside-rectangle  rectangle  x  y  =>  result

Arguments
rectangle  A list of integers.
x  An integer.
y  An integer.

Values
result  A boolean.

Description
The function inside-rectangle returns t if the point (x y) is inside rectangle. The rectangle is expected to be ordered; if the rectangle is specified by (left top right bottom), then left must be less than right, and top must be less than bottom. The lines y = bottom and x = right are not considered to be inside the rectangle.
invalidate-rectangle  

**Generic Function**

**Summary**
Invalidates the rectangle associated with the object, which causes it to be redisplayed.

**Package**
graphics-ports

**Signature**
invalidate-rectangle object &optional x y width height => result

**Arguments**

- **object**
  An instance of a subclass of graphics-ports-mixin or a subclass of pinboard-object.

- **x**
  A real number.

- **y**
  A real number.

- **width**
  A real number.

- **height**
  A real number.

**Values**

- **result**
  A boolean.

**Description**
By default, the generic function invalidate-rectangle invalidates the whole rectangle, but this can be limited by passing the optional arguments.

The effect of invalidating an area is to cause the area to be redrawn. It has no effect on pixmap-port. When the pane has a supplied display-callback, this callback is called with an area containing the area specified by the argument to invalidate-rectangle. However, the call to display-callback is asynchronous, and the system coalesces areas from calls to invalidate-rectangle and actual expose events, so there is not a one-to-one relation between calls to invalidate-rectangle and invocations of display-callback.

In general, invalidate-rectangle should not be called inside the display-callback. If it is called, it must be conditional, otherwise this will cause repeated redisplay.
Notes

With drawing-mode: quality, drawings are done with antialiasing, which means that they affect pixels which are not obviously part of the drawing. For example, drawing a rectangle with \( x = 10 \) may affect the pixel at \( x = 9 \). This needs to be taken into account when computing the arguments to invalidate-rectangle.

For pinboard objects the recommended way of forcing redraw is **redraw-pinboard-object**, which takes antialiasing into account.

Example

(exexample-edit-file "capi/graphics/plot-offline")

See also

invalidate-rectangle-from-points
validate-rectangle

Chapter 13, “Drawing - Graphics Ports”

invalidated-rectangle-from-points

*Function*

**Summary**

Invalidates a rectangle specified by two points, causing it to be redisplayed.

**Package**

graphics-ports

**Signature**

`invalidate-rectangle-from-points port x1 y1 x2 y2 &key extend extend-x extend-y`

**Arguments**

`port` A graphics port.

`x1, y1, x2, y2` Real numbers.

`extend, extend-x, extend-y` Real numbers.

**Description**

The function `invalidate-rectangle-from-points` invalidates a rectangle (by calling `invalidate-rectangle`) specified by two points. The coordinates of one point are \((x1, y1)\) and the other \((x2, y2)\). The points do not have to be ordered.
The keyword arguments specify extending the rectangle: 
*extend-x* extends the rectangle in the x dimension in both 
directions, and *extend-y* extends the rectangle in the y dimen-
sion in both directions. Both *extend-x* and *extend-y* default to 
*extend*, which itself defaults to 0 (that is, no extension).

\texttt{invalidate-rectangle-from-points} does not return a 
useful value.

See also \texttt{invalidate-rectangle}

\textbf{invert-transform} \hspace{1cm} \textit{Function}

\textbf{Summary} \hspace{0.5cm} Constructs the inverse of a transform.

\textbf{Package} \hspace{0.5cm} \texttt{graphics-ports}

\textbf{Signature} \hspace{0.5cm} \texttt{invert-transform \ transform \ &optional into \ => inverse}

\textbf{Arguments} \hspace{0.5cm} \texttt{transform} \hspace{0.5cm} A \texttt{transform} object.

\hspace{0.5cm} \texttt{into} \hspace{0.5cm} A \texttt{transform} object or \texttt{nil}.

\textbf{Values} \hspace{0.5cm} \texttt{inverse} \hspace{0.5cm} A \texttt{transform} object.

\textbf{Description} \hspace{0.5cm} This function constructs the inverse of \texttt{transform}. If \texttt{T} is \texttt{transform} and \texttt{T'} is its inverse, then \texttt{TT'} = 1. If \texttt{into} is non-nil it is 
modified to contain \texttt{T'} and returned, otherwise a new trans-
form is constructed and returned.

\textbf{Notes} \hspace{0.5cm} See \texttt{graphics-state} for details of how a \texttt{transform} is used.

See also \texttt{graphics-state}\n
\texttt{transform}
list-all-font-names

**Summary**
Finds the names of the available fonts.

**Package**
graphics-ports

**Signature**
list-all-font-names pane => fdescs

**Arguments**

- pane
A graphics port.

**Values**

- fdescs
A list of font description objects.

**Description**
The function `list-all-font-names` returns a list of partially-specified font description objects which contain the "name" attributes for each known font that is available for `pane`.

On Microsoft Windows and Cocoa the "name" attributes are just the `:family` attribute.

On X11 the "name" attributes are `:foundry` and `:family`.

See also
font-description-attributes
find-matching-fonts
Chapter 13, “Drawing - Graphics Ports”

list-known-image-formats

**Summary**
Returns the known image formats.

**Package**
graphics-ports

**Signature**
list-known-image-formats screen-spec &optional for-writing-too => formats

**Arguments**

- screen-spec
A CAPI object, a plist, or nil.

- for-writing-too
A generalized boolean.
### Values

<table>
<thead>
<tr>
<th>Description</th>
<th><code>formats</code></th>
<th>A list of keywords.</th>
</tr>
</thead>
</table>

The function `list-known-image-formats` returns a list of keywords which specify known image formats.

`screen-spec` is an object that `convert-to-screen` can recognize, typically a pane or simply `nil`.

If `for-writing-too` is not supplied or is `nil`, then `formats` is a list of formats that can be loaded. All the formats in the list can be loaded, but on Cocoa and Windows the list is not exhaustive, and it may be possible to load formats that are not listed.

If `for-writing-too` is supplied as non-nil, then `formats` is a list of types that `externalize-and-write-image` can write. In this case the list is exhaustive on all platforms, and `externalize-and-write-image` can write a format if and only if it appears in the list.

All platforms (except Motif) can read and write `:bmp`, `:jpg`, `:png` and `:tiff` images, and also recognize `:jpeg` as an alias for `:jpg`, so the list will always include all of these keywords.

See also

- `convert-to-screen`
- `externalize-and-write-image`
- Chapter 13, “Drawing - Graphics Ports”

### load-icon-image

**Function**

**Summary**

Loads a Windows icon image, and returns the image object.

**Package**

`graphics-ports`

**Signature**

`load-icon-image port id &key width height => image`

**Arguments**

- `port` A graphics port or CAPI object.
- `id` A keyword, string or pathname.
The function `load-icon-image` loads an icon specified by `id` which should be either a keyword describing a standard icon, or a string or a pathname naming a Windows format icon (*.ico) file. The following keyword values of `id` are recognized:

- `:sample` A rectangle
- `:hand` A cross in a circle
- `:ques` A question mark in a bubble
- `:bang` An exclamation mark in a triangle
- `:note` An 'I' in a bubble
- `:winlogo` The Windows logo
- `:warning` Same as `:bang`
- `:error` Same as `:hand`
- `:information` Same as `:note`

`load-icon-image` returns an `image` object which can be drawn to `port` using `draw-image` and which must be freed using `free-image` when no longer needed.

When `id` specifies a file and `width` and `height` are specified, then the most appropriate image is chosen from the icon file and is scaled accordingly. If `width` and `height` are `nil` the first image in the file is used at its natural size. `width` defaults to `nil` and `height` defaults to `width`.

**Note:** `load-icon-image` is defined only in LispWorks for Windows.
See also  draw-image
free-image
load-image
Chapter 13, “Drawing - Graphics Ports”

load-image  

Function

Summary  Loads an image and returns the image object.

Package  graphics-ports

Signature  load-image gp id &key cache type editable image-translation-table => image

Arguments  gp  A graphics port.

id  An image identifier, a file, an external-image, or an image.

cache  A boolean.

type  A keyword, or nil.

editable  One of the keywords :with-alpha and :without-alpha, or a boolean.

image-translation-table  An image translation table.

Values  image  An image object.

Description  The function load-image loads an image identified by id via the image-translation-table using the image load function registered with it. It returns an image object with the representation slot initialized. The gp argument specifies a graphics port used to identify the library. It also specifies the resource in which colors are defined and if necessary allocated for the image. If id is in the table but the translation is not an external image, and the image loader returns an external image as the
second value, that external image replaces the translation in the table. The default value of `image-translation-table` is `*default-image-translation-table*`.

`id` can be an `image`, which is just associated with the port `gp` and returned if it is a Plain Image or if `editable` is `nil`. Otherwise a new Plain Image object is returned, as described below.

`id` can also be a string or pathname denoting a file, and in this case the image is loaded according to `type`, as described below.

The `cache` argument controls whether the image translation is cached. See the `convert-external-image` function for more details.

`type` tells `load-image` that the image is in a particular graphics format. Currently the only recognized value is `:bmp`, which means the image is a Bitmap. Other values of `type` cause `load-image` to load the image according to the file type of `id`, if `id` denotes a file, as described for `read-external-image`. See Chapter 13, “Drawing - Graphics Ports” for a discussion of image handling. The default value of `type` is `nil`.

`editable` controls whether the image `image` is a Plain Image suitable for use with the Image Access API. The values of `editable` have the following effects:

- `nil` The image is not editable.
- `:without-alpha` The image is editable, but does not have an alpha channel.
- `t` The image is editable, but does not have an alpha channel if the source of the image has an alpha channel (for example, a TIFF file with alpha channel).
The image is editable and has an alpha channel. It will be fully opaque when loading files without an alpha channel.

Given an image my-image, call

(load-image port my-image :editable t)

to create an image guaranteed to work with make-image-access. The default value of editable is nil.

Normally the image is freed automatically, when gp is destroyed. However there are circumstances where you need to explicitly free an image, for example when you want it to go away before the port. If the image is not freed, a memory leak occurs.

Note: gp must already be created at the time load-image is called. If you need to delay loading the image, for example if you are computing the image dynamically, then you can call load-image in the create-callback of the port or even in its first display-callback.

Compatibility note

In LispWorks 4.4 there is a keyword argument :force-plain with the same effect as :editable. :force-plain is still accepted in LispWorks 7.0 for backwards compatibility, but you should now use :editable instead.

See also

convert-external-image
*default-image-translation-table*
load-icon-image
make-image
make-image-access
Chapter 13, “Drawing - Graphics Ports”

make-dither

Function

Summary

Makes a dither matrix of a given size.
Package graphics-ports

Signature make-dither size => matrix

Arguments size An integer.

Values matrix A dither matrix.

Description The function make-dither makes a dither matrix of the given size.

Notes make-dither is deprecated. Dithers do not affect drawing or anti-aliasing.

See also dither-color-spec
initialize-dithers
with-dither

**make-font-description**

*Function*

Summary Returns a new font description object containing given font attributes.

Package graphics-ports

Signature make-font-description &rest font-attribute* => fdesc

Arguments font-attribute A font attribute.

Values fdesc A font description object.

Description The function make-font-description returns a new font description object containing the given font attributes. There is no error checking of the attributes at this point.

The attribute :stock is handled specially: it is omitted from fdesc, unless it is the only attribute specified.
See also

- augment-font-description
- convert-to-font-description
- find-best-font
- find-matching-fonts
- font-description
- merge-font-descriptions

**make-graphics-state**

*Function*

**Summary**

Creates a `graphics-state` object.

**Package**

`graphics-ports`

**Signature**

```
make-graphics-state &key transform foreground background operation thickness scale-thickness dashed dash line-end-style line-joint-style mask fill-style stipple pattern mask-x mask-y font text-mode shape-mode compositing-mode mask-transform => state
```

**Arguments**

See `graphics-state` for interpretation of the arguments.

**Values**

`state` A `graphics-state` object.

**Description**

The function `make-graphics-state` creates a `graphics-state` object. Each graphics port has a graphics state associated with it, but you may want to create your own individual graphics states for use in specialized drawing operations. Graphics state objects do not consume local resources beyond dynamic memory for the structure (so you can be relaxed about creating them in some number if you really need to).

See also

- `graphics-state`
- `set-graphics-state`
**make-image**

**Function**

**Summary**
Makes a new, empty, image object.

**Package**
graphics-ports

**Signature**
make-image port width height &key alpha => image

**Arguments**
- **port**
  A graphics port.
- **width**
  A positive integer.
- **height**
  A positive integer.
- **alpha**
  A generalized boolean.

**Values**
- **image**
  An image object.

**Description**
The function make-image makes a new blank, editable image object associated with port and of the given width and height.

On Windows and Cocoa, if alpha is true, then the image will have an alpha channel.

The initial pixels in image are undefined. image is editable, that is, it is suitable for use with the Image Access API. To set the pixels, see make-image-access.

**See also**
- load-image
- make-image-access

**make-image-access**

**Generic Function**

**Summary**
Creates an Image Access object.

**Package**
graphics-ports

**Signature**
make-image-access port image => image-access
Arguments

- **port**: A graphics port.
- **image**: An *image* object.

Values

- **image-access**: An Image Access object.

Description

The generic function `make-image-access` returns an Image Access object for the given *image*.

*image* can be any *image* object returned by `make-image-from-port`. An *image* object returned by `load-image` is also suitable, but only if it is a Plain Image (see below).

`image-access` is used when reading and writing the pixel values of the image. For an overview of using Image Access objects, see “Image access” on page 224.

Notes

1. On some platforms (currently Windows) not every *image* object is a Plain Image. If needed, forcibly create a Plain Image suitable for passing to `make-image-access` as described in `load-image`.

2. Ensure that you eventually discard *image-access*, using `free-image-access`.

Example

```
(example-edit-file "capi/graphics/image-access")
```

See also

- `free-image-access`
- `image-access-transfer-from-image`
- `image-access-transfer-to-image`
- `image-access-height`
- `image-access-pixel`
- `load-image`
- `make-image`
- “Image access” on page 224
**make-image-from-port**

<table>
<thead>
<tr>
<th>Summary</th>
<th>Makes an image out of a specified rectangle of a graphics port’s contents.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>graphics-ports</td>
</tr>
<tr>
<td>Signature</td>
<td>make-image-from-port port &amp;optional x y width height =&gt; image</td>
</tr>
<tr>
<td>Arguments</td>
<td>port A graphics port. x An integer. y An integer. width An integer. height</td>
</tr>
<tr>
<td></td>
<td>An integer.</td>
</tr>
<tr>
<td>Values</td>
<td>image An image.</td>
</tr>
<tr>
<td>Description</td>
<td>The function make-image-from-port makes an image out of the specified rectangle of the port's contents. The default is the whole port, but a region can be specified using x, y, width, and height. The default value of x and y is 0. Normally the image is freed automatically, when port is destroyed. However there are circumstances where you need to explicitly free an image, for example when you want it to go away before the port. If the image is not freed, a memory leak occurs.</td>
</tr>
<tr>
<td>See also</td>
<td>externalize-image</td>
</tr>
<tr>
<td></td>
<td>Chapter 13, “Drawing - Graphics Ports”</td>
</tr>
</tbody>
</table>

**make-sub-image**

| Summary          | Makes a new image from part of an image.                                 |

---

1125
Package  graphics-ports

Signature  make-sub-image  port  image  &optional  x  y  width  height  =>  sub-image

Arguments  
port  A graphics port.
image  An image.
x  An integer.
y  An integer.
width  An integer.
height  An integer.

Values  
sub-image  An image.

Description  The function make-sub-image makes a new image object from the rectangular region of the supplied image specified by x, y, width and height.
The default values of x and y are 0.
The default value of width is the width of image.
The default value of height is the height of image.

See also  image
Chapter 13, “Drawing - Graphics Ports”
Chapter 17, “Drag and Drop”

make-transform  

Function

Summary  Returns a new transform object initialized according to a set of optional arguments.

Package  graphics-ports

Signature  make-transform  &optional  a  b  c  d  e  f  =>  transform
Arguments  \(a, b, c, d, e, f\)  Real numbers.

Values  \(transform\)  A \texttt{transform} object.

Description  The function \texttt{make-transform} returns a new transform object initialized according to the optional args. The default args make the unit transform.

Default values are as follows: \(a\) and \(d\) are 1; \(b, c, e,\) and \(f\) are 0. The transform matrix is

\[
\begin{pmatrix}
a & b & 0 \\
c & d & 0 \\
e & f & 1 \\
\end{pmatrix}
\]

for generalized two dimensional points of the form \((x \ y \ 1)\).

Notes  See \texttt{graphics-state} for details of how a \texttt{transform} is used.

Example  This transform will cause rotation by \(\pi/4\) radians:

\[
(\text{let } ((s \ (\sin \ (/ \ pi \ 4))))
\quad (c \ (\cos \ (/ \ pi \ 4))))
\quad (\text{gp:make-transform} \ c \ s \ (- \ s) \ c \ 0 \ 0))
\]

See also  \texttt{graphics-state}  \texttt{transform}

\textbf{merge-font-descriptions}  \textit{Function}

Summary  Returns a font description containing the attributes of two specified font descriptions.

Package  \texttt{graphics-ports}

Signature  \texttt{merge-font-descriptions fdesc1 fdesc2 => fdesc}

Arguments  \(fdesc1\)  A font description.

\(fdesc2\)  A font description.
Values

| fdesc | A font description. |

Description

The function `merge-font-descriptions` returns a font description containing all the attributes of `fdesc1` and `fdesc2`. If an attribute appears in both `fdesc1` and `fdesc2`, the value in `fdesc1` is used. The attribute `:stock` is handled specially: it is omitted from `fdesc`, unless it is the only attribute in `fdesc1` and `fdesc2`.

The contents of `fdesc1` and `fdesc2` are not modified.

See also

- `make-font-description`
- Chapter 13, “Drawing - Graphics Ports”

### offset-rectangle

*Function (inline)*

Summary

Offsets a rectangle by a given distance.

Package

`graphics-ports`

Signature

`offset-rectangle rectangle dx dy`

Arguments

- `rectangle` A list of integers.
- `dx` A real number.
- `dy` A real number.

Description

The function `offset-rectangle` offsets the `rectangle` by the distance `(dx dy)`. `rectangle` is a list (left top right bottom).

### ordered-rectangle-union

*Function*

Summary

Returns the union of two rectangles.
Package: graphics-ports

Signature: ordered-rectangle-union left-1 top-1 right-1 bottom-1 left-2 top-2 right-2 bottom-2 => left, top, right, bottom

Arguments:
- left-1, top-1, right-1, bottom-1
  Real numbers.
- left-2, top-2, right-2, bottom-2
  Real numbers.

Values: left, top, right, bottom
Real numbers.

Description: The function ordered-rectangle-union returns four values: the left, top, right and bottom of the union of the two rectangles specified in the arguments. The caller guarantees that each input rectangle is ordered, that is, the left values must be smaller or equal to the right values, and the top values must be greater than or equal to the bottom ones.

See also: rectangle-union

pi-by-2

Constant

Summary: (/ pi 2) as a double-float.

Package: graphics-ports

Description: The constant pi-by-2 is the result of (/ cl:pi 2). It is a cl:double-float.

See also: 2pi, fpi
pixblt

Function

Summary
Copies one area of a graphics port to another area of a different graphics port.
pixblt is deprecated.

Package
graphics-ports

Signature
pixblt to-port operation from-port to-x to-y width height from-x from-y

Arguments
to-port A graphics port.
operation A graphics state operation.
from-port A graphics port.
to-x A real number.
to-y A real number.
width A real number.
height A real number.
from-x A real number.
from-y A real number.

Description
The deprecated function pixblt copies one area of from-port to another area of to-port using the specified operation and mask. Both ports should be the same depth. The graphics port transforms are not used.

operation is ignored when the drawing-mode is :quality (the default). See “Combining pixels with :compatible drawing” on page 215 for valid values for operation.

pixblt is deprecated, because the :quality drawing-mode does not support operation, and because it ignores the transformations, which means it does not always work as expected. In particular, it can draw at the wrong place inside the display-callback of output-pane.
Use instead **copy-area**, which does take account of the transform. See also **graphics-state** parameter *compositing-mode* for a way to control how **copy-area** blends the source and the target.

See also

- **copy-area**
- **graphics-state**

Chapter 13, “Drawing - Graphics Ports”

**pixmap-port**

*Class*

**Summary**
The class of pixmap graphics port objects.

**Package**

**graphics-ports**

**Description**
The class **pixmap-port** is the class of pixmap graphics port objects which can be used for drawing operations.

See also

- **create-pixmap-port**
- **destroy-pixmap-port**
- **with-pixmap-graphics-port**

**port-drawing-mode-quality-p**

*Generic Function*

**Summary**
Tests whether a port does quality drawing.

**Package**

**graphics-ports**

**Signature**

```lisp
port-drawing-mode-quality-p port => result
```

**Arguments**

- **port**
  A graphics port.

**Value**

- **result**
  A boolean.
Description

The generic function `port-drawing-mode-quality-p` returns true if the graphics port `port` does quality drawing.

A port does quality drawing if both

1. it was not made with `drawing-mode :compatible`, and
2. the underlying library supports quality drawing.

Microsoft Windows and Cocoa always support quality drawing, GTK+ supports it from version 2.8 and greater, but Motif never supports it.

Examples

(example-edit-file "capi/graphics/images-with-alpha")

See also

“The drawing mode and anti-aliasing” on page 209.

---

**port-graphics-state**

Function

Summary

Returns the `graphics-state` object for a graphics port.

Package

graphics-ports

Signature

`port-graphics-state port => state`

Arguments

`port` A graphics port.

Values

`state` A `graphics-state` object.

Description

The function `port-graphics-state` returns the `graphics-state` object for `port`. The individual slots can be accessed using the accessor functions documented for `graphics-state`.

See also

`graphics-state`
### port-height

**Summary**
Returns the pixel height of a port.

**Package**
`graphics-ports`

**Signature**
`port-height port => result`

**Arguments**
- `port` A graphics port.

**Values**
- `result` An integer.

**Description**
The function `port-height` returns the pixel height of `port`.

### port-owner

**Summary**
Returns the port owner of a graphics port.

**Package**
`graphics-ports`

**Signature**
`port-owner graphics-port => owner`

**Arguments**
- `graphics-port` A graphics port.

**Values**
- `owner` A graphics port.

**Description**
The function `port-owner` returns the port owner of the graphics port `graphics-port`.

For `output-pane` the owner is always the pane itself.

For `pixmap-port` it is the owner of the port that was used when it was made.

For `metafile-port` the owner can be specified by the keyword argument `:owner` in the macros `with-internal-metafile` and `with-external-metafile`, otherwise it is the port itself.
For **printer-port** the owner can be specified by the keyword argument `:owner in with-print-job`, otherwise it is the port itself.

### port-string-height

**Function**

**Summary**
Returs the height of a string drawn to a given port in pixels.

**Package**
**graphics-ports**

**Signature**
`port-string-height port string => height`

**Arguments**
- `port`  A graphics port.
- `string`  A string.

**Values**
- `height`  An integer.

**Description**
The function **port-string-height** returns the **height** in pixels of `string` when drawn to `port`. The font used is the **font** currently in the port’s **graphics-state**.

### port-string-width

**Function**

**Summary**
Returs the width of a string drawn to a given port in pixels.

**Package**
**graphics-ports**

**Signature**
`port-string-width port string => width`

**Arguments**
- `port`  A graphics port.
- `string`  A string.

**Values**
- `width`  An integer.
| Description | The function `port-string-width` returns the width in pixels of string when drawn to port. The font used is the font currently in the port's `graphics-state`. |
| Notes | To compute the horizontal extents of each successive character in a string for a given port or font, use `compute-char-extents`. |
| See also | `compute-char-extents` |

### port-width

**Function**

**Summary**

Returns the pixel width of a port.

**Package**

`graphics-ports`

**Signature**

`port-width port => width`

**Arguments**

`port` A graphics port.

**Values**

`width` An integer.

**Description**

The function `port-width` returns the pixel width of `port`.

### postmultiply-transforms

**Function**

**Summary**

Postmultiplies two transforms.

**Package**

`graphics-ports`

**Signature**

`postmultiply-transforms transform1 transform2`

**Arguments**

`transform1` A `transform` object.

`transfrom2` A `transform` object.
Description

The function `postmultiply-transforms` postmultiplies the partial 3 x 3 matrix represented by `transform1` by the partial 3 x 3 matrix represented by `transform2`, storing the result in `transform1`. In the result, the translation, scaling and rotation operations contained in `transform2` are effectively performed after those in `transform1`.

\[ \text{transform1} = \text{transform1} \times \text{transform2} \]

`premultiply-transforms`  

Function

**Summary**

Premultiplies two transforms.

**Package**

`graphics-ports`

**Signature**

`premultiply-transforms` `transform1` `transform2`

**Arguments**

`transform1` A `transform` object.

`transform2` A `transform` object.

**Description**

The function `premultiply-transforms` premultiplies the partial 3 x 3 matrix represented by `transform1` by the partial 3 x 3 matrix represented by `transform2`, storing the result in `transform1`. In the result, the translation, scaling and rotation operations contained in `transform2` are effectively performed before those in `transform1`.

\[ \text{transform1} = \text{transform2} \times \text{transform1} \]

`read-and-convert-external-image`  

Function

**Summary**

Returns an image converted from an external image read from a file.

**Package**

`graphics-ports`
Signature

`read-and-convert-external-image gp file &key transparent-color-index => image, external-image`

Arguments

- `gp`: A CAPI pane.
- `file`: A pathname designator.
- `transparent-color-index`: An integer or `nil`.

Values

- `image`: An `image`.
- `external-image`: An `external-image`.

Description

Returns an `image` converted from an external image read from `file`. The external image is returned as a second value. `transparent-color-index` is interpreted as described for `read-external-image`.

See also

- `convert-external-image`
- `external-image`
- `read-external-image`

Chapter 13, “Drawing - Graphics Ports”

---

**read-external-image**

**Function**

**Summary**

Returns an external image read from a file.

**Package**

`graphics-ports`

**Signature**

`read-external-image file &key transparent-color-index type => image`

**Arguments**

- `file`: A pathname designator.
- `transparent-color-index`: An integer, a cons or `nil`.

1137
**type**

A keyword, or nil.

**Values**

- **image** An external image.

**Description**

The function `read-external-image` returns an external image read from file.

If `transparent-color-index` is an integer it specifies the index of the transparent color in the color map.

`transparent-color-index` can also be a cons `(index . new-color)` where `new-color` is a color specification that is converted to the color to use instead of the color at index `index` in the color map. `new-color` can also be the keyword `:transparent`. On most platforms this makes it truly transparent. On Motif it uses the background of the pane that it is associated with by `load-image`.

`transparent-color-index` works only for images with a color map, that is, those with 256 colors or less. The default value is `nil`, meaning that there is no transparent color.

`type` tells `read-external-image` that the image is in a particular graphics format. Currently the only recognized value is `:bmp`, which means the image is read as a Bitmap. Other values of `type` cause `read-external-image` to read the image according to the file type of `file`. "bmp" or "dib" mean that the image is read as a Bitmap. Other file types are handled in Operating System-specific ways. See “Working with images” on page 219 for details. The default value of `type` is `nil`.

**Example**

To see the effect of `transparent-color-index`, do:

1. `(example-edit-file "capi/graphics/images")`
2. Specify a non-white :background for the viewer pane.
   
   Use an image editing tool to find the transparent color index (183 in this image) and change the call to `read-external-image` like this:
   
   `(gp:read-external-image file
                :transparent-color-index 183)`
3. Then compile and run the example, click the Change... button and select the Setup.bmp file.

See also external-image

rect-bind

Macro

Summary Binds four variables to the elements of a rectangle across a body of code.

Package graphics-ports

Signature rect-bind ((x y width height) rectangle) &body body => result

Arguments x A variable.
y A variable.
width A variable.
height A variable.
rectangle A rectangle.
body A body of Lisp code.

Values result The return value of the last form in body.

Description The macro rect-bind binds x y width height to the appropriate values from rectangle and executes the body forms. The rectangle is a list of the form (left top right bottom).

rectangle-bind

Macro

Summary Binds four variables to the corners of a rectangle across a body of code.

Package graphics-ports
Signature  
\texttt{rectangle-bind} ((a b c d) rectangle) \texttt{&body body} => result

Arguments  
a  A variable.
b  A variable.
c  A variable.
d  A variable.
rectangles  A rectangle.
body  A body of code.

Values  
result  The return value of the last form in \texttt{body}.

Description  
The macro \texttt{rectangle-bind} binds the variables \texttt{a b c d} to \texttt{left top right bottom} of \texttt{rectangle} for the \texttt{body} of the macro.

\textbf{rectangle-bottom}

Macro

Summary  
Get and sets the \texttt{bottom} element of a rectangle.

Package  
\texttt{graphics-ports}

Signature  
\texttt{rectangle-bottom rectangle} => bottom

Signature  
(setf rectangle-bottom) bottom rectangle => bottom

Arguments  
rectangle  A rectangle.

Values  
bottom  A real number.

Description  
The macro \texttt{rectangle-bottom} returns and via \texttt{setf} sets the \texttt{bottom} element of \texttt{rectangle}.

\texttt{rectangle} is a list of numbers (\texttt{left top right bottom}).
rectangle-height

**Macro**

**Summary**
Returns the *height* element of a rectangle.

**Package**
graphics-ports

**Signature**
rectangle-height rectangle => height

**Arguments**
rectangle A rectangle.

**Values**
height A real number.

**Description**
The macro *rectangle-height* returns the difference between the *bottom* and *top* elements of *rectangle*. *rectangle* is a list of numbers (left top right bottom).

rectangle-left

**Macro**

**Summary**
Gets and set the *left* element of a rectangle.

**Package**
graphics-ports

**Signature**
rectangle-left rectangle => left

**Signature**
(setf rectangle-left) left rectangle => left

**Arguments**
rectangle A rectangle.

**Values**
left A real number.

**Description**
The macro *rectangle-left* returns and via *setf* sets the *left* element of *rectangle*. *rectangle* is a list of numbers (left top right bottom).
rectangle-right

Macro

Summary
Gets and sets the right element of a rectangle.

Package
graphics-ports

Signature
rectangle-right rectangle => right

Signature
(setf rectangle-right) right rectangle => right

Arguments
rectangle A rectangle.

Values
right A real number.

Description
The macro rectangle-right returns and via setf sets the right element of rectangle.
rectangle is a list of numbers (left top right bottom).

rectangle-top

Macro

Summary
Gets and sets the top element of a rectangle.

Package
graphics-ports

Signature
rectangle-top rectangle => top

Signature
(setf rectangle-top) top rectangle => top

Arguments
rectangle A rectangle.

Values
top A real number.

Description
The macro rectangle-top returns and via setf sets the top element of rectangle.
rectangle is a list of numbers (left top right bottom).
rectangle-union

Function

Summary
Returns the four values representing a union of two rectangles.

Package
graphics-ports

Signature
rectangle-union left-1 top-1 right-1 bottom-1
gleft-2 top-2 right-2 bottom-2
=> left, top, right, bottom

Arguments
left-1 A real number.
top-1 A real number.
right-1 A real number.
bottom-1 A real number.
left-2 A real number.
top-2 A real number.
right-2 A real number.
bottom-2 A real number.

Values
left A real number.
top A real number.
right A real number.
bottom A real number.

Description
The function rectangle-union returns four values: the left, top, right and bottom of the union of the two rectangles specified in the arguments. The values input for the two rectangles are ordered by this function before it uses them.

See also
ordered-rectangle-union
rectangle-width

**Macro**

**Summary**
Returns the difference between the left and right elements of a rectangle.

**Package**
graphics-ports

**Signature**
rectangle-width rectangle => width

**Arguments**
rectangle
A rectangle

**Values**
width
A real number

**Description**
The macro rectangle-width returns the difference between right and left elements of rectangle.
rectangle is a list of numbers (left top right bottom).

register-image-load-function

**Function**

**Summary**
Registers one or more image identifiers with an image loading function.

**Package**
graphics-ports

**Signature**
register-image-load-function image-id image-load-function &key image-translation-table

**Arguments**
image-id
An image identifier or a list of image identifiers.

image-load-function
A function.

image-translation-table
An image translation table.
The function `register-image-load-function` registers one or more `image-ids` with an `image-load-function` in the `image-translation-table`. If `image-load-function` is `nil` it causes the default loader to be used in subsequent calls to `load-image`. The `image-id` argument can be a list of identifiers or a single identifier. The default value of `image-translation-table` is `*default-image-translation-table*`.

See also `*default-image-translation-table*`  
`load-image`

**register-image-translation**

**Function**

**Summary**

Registers an image identifier and image loading function with a translation in an image translation table.

**Package**

`graphics-ports`

**Signature**

`register-image-translation image-id translation &key image-translation-table image-load-fn`

**Arguments**

- `image-id` An image identifier.
- `translation` An image translation.
- `image-translation-table` An image translation table.
- `image-load-fn` An image loading function.

**Description**

The function `register-image-translation` registers `image-id` and `image-load-fn` with the `translation` in the `image-translation-table`. When `load-image` is called with second argument `image-id`, the `image-load-fn` is called with `translation` as its second argument. If `image-load-fn` is `nil`, the image translation table’s default image loader is used; this converts an external image object or file to an image. If `translation` is `nil`
the identifier is deregistered. Returns the image-id and the
image-load-fn. The default value of image-translation-table is
*default-image-translation-table*.

See also *default-image-translation-table*
load-image
reset-image-translation-table
Chapter 13, “Drawing - Graphics Ports”

reset-image-translation-table

Function

Summary Clears the image translation table hash tables.

Package graphics-ports

Signature reset-image-translation-table &key image-translation-table

Arguments image-translation-table

An image translation table.

Description The function reset-image-translation-table clears the
image translation table hash tables and set the default image-
load-fn to read-and-convert-external-image. The default
value of image-translation-table is *default-image-translation-table*.

See also *default-image-translation-table*
read-and-convert-external-image
register-image-translation

separation

Function

Summary Returns the distance between two points.

Package graphics-ports
Signature  \[ \text{separation } x_1 \ y_1 \ x_2 \ y_2 \Rightarrow dist \]

Arguments  
- \( x_1 \)  An integer.
- \( y_1 \)  An integer.
- \( x_2 \)  An integer.
- \( y_2 \)  An integer.

Values  
- \( dist \)  A real number.

Description  The function \text{separation} returns the distance between points \((x_1 \ y_1)\) and \((x_2 \ y_2)\).

\[set-default-image-load-function\]  

Function

Summary  Sets the default image load function of an image translation table.

Package  \text{graphics-ports}

Signature  
\[
\text{set-default-image-load-function} \ image-load-function \ &\text{key} \ image-translation-table
\]

Arguments  
- \( image-load-function \)  An image load function.
- \( image-translation-table \)  An image translation function.

Description  The function \text{set-default-image-load-function} sets the default image load function of \text{image-translation-table}. The default image load function is \text{read-and-convert-external-image}. The default value of \text{image-translation-table} is \text{*default-image-translation-table*}. 

1147
**set-graphics-port-coordinates**

*Function*

**Summary**
Modifies the *transform* of a port such that the edges of the port correspond to the arguments given.

**Package**
graphics-ports

**Signature**

```
set-graphics-port-coordinates port &key left top right bottom
```

**Arguments**

- `port` A graphics port.
- `left` A real number.
- `top` A real number.
- `right` A real number.
- `bottom` A real number.

**Description**
The generic function `set-graphics-port-coordinates` modifies the *transform* of the graphics port `port` permanently such that the edges of `port` correspond to the values of the other arguments.

**Notes**
The *transform* is part of the port’s graphics state. See `graphics-state` for details of how it is used.

**Example**
The following code

```
(set-graphics-port-coordinates port :left -1.0
    :top 1.0
    :right 1.0
    :bottom -1.0)
```
changes the coordinates of the port so that the point (0, 0) is in the exact center of the port and the edges are a unit distance away, with a right-handed coordinate system.

By default, left and top are 1.

See also graphics-state

set-graphics-state  

Function

Summary  
Directly alters the graphics-state of a graphics port according to the keyword arguments supplied.

Package  
graphics-ports

Signature  
set-graphics-state port &rest args &key transform foreground background operation stipple pattern fill-style thickness scale-thickness dashed dash line-end-style line-joint-style mask mask-x mask-y font shape-mode text-mode compositing-mode mask-transform

Arguments  
port  
A graphics port.

Description  
The function set-graphics-state directly alters the graphics state of port according to the values of the keyword arguments args. Unspecified keywords leave the associated slots unchanged.

See graphics-state for valid values for args.

See also  
graphics-state  
with-graphics-state  
Chapter 13, “Drawing - Graphics Ports”

transform  

Type

Summary  
The transform type, defined for transform objects.
Package graphics-ports

Description The type transform is the type defined for transform objects, which are six-element lists of numbers.

Notes For information about how transforms are used, see graphics-state.

See also graphics-port-transform
Chapter 6, “Laying Out CAPI Panes”
Chapter 13, “Drawing - Graphics Ports”

transform-area Function

Summary Transforms a set of points and returns the resulting rectangle.

Package graphics-ports

Signature transform-area transform x y width height => rectangle

Arguments

- transform A transform.
- x A real number.
- y A real number.
- width A real number.
- height A real number.

Values rectangle A rectangle.

Description The function transform-area transforms the points (x y) and (x+width y+height) and returns the transformed rectangle as (x y width height) values.

See also transform
**transform-distance**  
*Function*

**Summary**  
Transforms a distance vector by the rotation and scale of a transform.

**Package**  
*graphics-ports*

**Signature**  
transform-distance transform dx dy => dx2, dy2

**Arguments**
- *transform*  
  A transform.
- *dx*  
  A real number.
- *dy*  
  A real number.

**Values**
- *dx2*  
  A real number.
- *dy2*  
  A real number.

**Description**  
The function `transform-distance` transforms the distance `(dx dy)` by the rotation and scale in the `transform`. The translation in the transform is ignored. Transformed `(dx dy)` is returned as two values.

**See also**  
`transform`

**transform-distances**  
*Function*

**Summary**  
Transforms a list of alternating distance vectors by a given transform.

**Package**  
*graphics-ports*

**Signature**  
transform-distances transform distances => result

**Arguments**
- *transform*  
  A transform.
- *distances*  
  A list of pairs of real numbers.
Values

result

A list of pairs of real numbers.

Description

The function transform-distances transforms a list of alternating (dx dy) pairs in distances by the transform. Transformed values are returned as a new list.

See also

transform

transform-is-rotated

Function

Summary

Returns t if a given transform contains a rotation.

Package

graphics-ports

Signature

transform-is-rotated transform => bool

Arguments

transform A transform.

Values

bool A boolean.

Description

The function transform-is-rotated returns t if transform contains any rotation.

See also

transform

transform-point

Function

Summary

Transforms a point by multiplying it by a transform.

Package

graphics-ports

Signature

transform-point transform x y => xnew ynew

Arguments

transform A transform.
The function \texttt{transform-point} transforms the point \((x, y)\) by multiplying it by \texttt{transform}. The transformed \((x, y)\) is returned as two values.

See also \texttt{transform}

\textbf{transform-points} \hspace{1cm} \textit{Function}

\textbf{Summary} \hspace{1cm} Transforms a list of points by a transform.

\textbf{Package} \hspace{1cm} \texttt{graphics-ports}

\textbf{Signature} \hspace{1cm} \texttt{transform-points transform points &optional into => result}

\textbf{Arguments} \hspace{1cm} \texttt{transform} \hspace{1cm} A \texttt{transform}.
\hspace{1cm} \texttt{points} \hspace{1cm} A list of pairs of real numbers.
\hspace{1cm} \texttt{into} \hspace{1cm} A list.

\textbf{Values} \hspace{1cm} \texttt{result} \hspace{1cm} A list of pairs of real numbers.

\textbf{Description} \hspace{1cm} The function \texttt{transform-points} transforms a list of alternating \((x, y)\) pairs in \texttt{points} by the \texttt{transform}. If \texttt{into} is supplied it is modified to contain the result and must be a list the same length as \texttt{points}. If \texttt{into} is not supplied, a new list is returned.

See also \texttt{transform}
### transform-rect

**Summary**
Returns the transform of two points representing the top-left and bottom-right of a rectangle.

**Package**
graphics-ports

**Signature**
```
transform-rect transform left top right bottom => left2 top2 right2 bottom2
```

**Arguments**
- **transform** A transform.
- **left** A real number.
- **top** A real number.
- **right** A real number.
- **bottom** A real number.

**Values**
- **left2** A real number.
- **top2** A real number.
- **right2** A real number.
- **bottom2** A real number.

**Description**
The function `transform-rect` transforms the rectangle represented by the two points `(left top)` and `(right bottom)` by `transform`.

**See also**
transform

### undefined-font-alias

**Summary**
Removes a font alias.

**Package**
graphics-ports
## Signature

**define-font-alias** *keyword*

## Arguments

**keyword**

A keyword.

## Description

The function **define-font-alias** removes the font alias named by *keyword*.

---

### union-rectangle

**Macro**

#### Summary

Modifies a rectangle to be a union of itself and another rectangle.

#### Package

**graphics-ports**

#### Signature

**union-rectangle** *rectangle left top right bottom => rectangle*

#### Arguments

- **rectangle**
  
  A rectangle.

- **left**
  
  A real number.

- **right**
  
  A real number.

- **top**
  
  A real number.

- **bottom**
  
  A real number.

#### Values

- **rectangle**
  
  A rectangle.

#### Description

The macro **union-rectangle** modifies the *rectangle* to be the union of *rectangle* and *(left top right bottom)*.

---

### *unit-transform*

**Variable**

#### Summary

The list *(1 0 0 1 0 0)*.

#### Package

**graphics-ports**
The variable *unit-transform* holds the list \((1 0 0 1 0 0)\) which is the unit transform \(I\), such that \(X = XI\), where \(X\) is a 3-vector. Graphics ports are initialized with the unit transform in their graphics-state. This means that port coordinate axes are initially the same as the window axes.

**Summary**

Returns \(t\) if a given transform is a unit transform.

**Package**

graphics-ports

**Signature**

`unit-transform-p transform => bool`

**Arguments**

`transform` A transform.

**Values**

`bool` A boolean.

**Description**

The function `unit-transform-p` returns \(t\) if `transform` is the unit transform.

**Notes**

See graphics-state for details of how a `transform` is used.

**See also**

graphics-state

**unless-empty-rect-bind**

**Summary**

Binds the elements of a rectangle to four variables, and if the rectangle has a non-zero area, executes a body of code.

**Package**

graphics-ports
### unless-empty-rect-bind

**Signature**
```
unless-empty-rect-bind ((x y width height) rectangle) &body
body => result
```

**Arguments**
- **x**: A variable.
- **y**: A variable.
- **width**: A variable.
- **height**: A variable.
- **rectangle**: A rectangle.
- **body**: A body of Lisp code.

**Values**
- **result**: The return value of the last form executed in `body`.

**Description**
The macro `unless-empty-rect-bind` binds `x`, `y`, `width`, and `height` to the appropriate values from `rectangle` and if the `width` and `height` are both positive, executes the `body` forms.

### untransform-distance

**Function**

**Summary**
Transforms a distance by the rotation and scale of the inverse of a given transform.

**Package**
`graphics-ports`

**Signature**
```
untransform-distance transform dx dy => x, y
```

**Arguments**
- **transform**: A transform.
- **dx**: A real number.
- **dy**: A real number.

**Values**
- **x**: A real number.
- **y**: A real number.
The function `untransform-distance` transforms the distance \((dx \ dy)\) by the rotation and scale of the effective inverse of \(transform\). The translation in the inverse transform is ignored. The transformed distance \((dx \ dy)\) is returned as two values.

See `graphics-state` for details of how a `transform` is used.

See also `graphics-state` `transform`

### `untransform-distances`  
**Function**

Transforms a list of integer pairs representing distances by the inverse of a `transform`.

**Signature**
```
untransform-distances transform distances => result
```

**Arguments**
- `transform`: A `transform`.
- `distances`: A list of pairs of real numbers.

**Values**
- `result`: A list of pairs of real numbers.

The function `untransform-distances` transforms a list of alternating \((dx \ dy)\) pairs in `distances` by the effective inverse of `transform`. Transformed values are returned as a new list.

See `graphics-state` for details of how a `transform` is used.

See also `graphics-state` `transform`
untransform-point  

Function

Summary
Transforms a point by multiplying it by the inverse of a given transform.

Package  
graphics-ports

Signature
untransform-point transform x y => x2, y2

Arguments
transform  
A transform.

x  
A real number.

y  
A real number.

Values
x2  
A real number.

y2  
A real number.

Description
The function untransform-point transforms the point (x y) by effectively multiplying it by the inverse of transform. The transformed (x y) is returned as two values.

untransform-points  

Function

Summary
Transforms a list of points by the inverse of a given transform.

Package  
graphics-ports

Signature
untransform-points transform points &optional into => result

Arguments
transform  
A transform.

points  
A list of pairs of real numbers.

into  
A list.

Values
result  
A list of pairs of real numbers.
Description
The function untransform-points transforms a list of alternating (x y) pairs in points by the effective inverse of transform. If into is supplied it must be a list the same length as points. If into is not supplied, a new list is returned.

validate-rectangle

Generic Function

Summary
Validates the rectangle associated with the object, marks it as already drawn.

Package
graphics-ports

Signature
validate-rectangle object &optional x y width height => result

Arguments
object
An instance of a subclass of graphics-ports-mixin or a subclass of pinboard-object.

x
A real number.

y
A real number.

width
A real number.

height
A real number.

Values
result
A boolean.

Description
The function validate-rectangle validates the rectangle associated with object and marks it as already drawn.

The given area of object is marked as not needing to be displayed. This can be useful if you want to draw that area immediately and avoid it being drawn again by the window system. By default validate-rectangle validates the whole rectangle, but this can be limited by passing the optional arguments.
result is non-nil if the function succeeds and nil if it fails (doing nothing).

Notes   validate-rectangle is not fully implemented on all platforms.
On Windows, it succeeds for all valid values of \( x, y, width \) and \( height \).
On Cocoa, it fails if \( x, y, width \) and \( height \) are passed.
On Motif, it fails in all cases.

See also invalidate-rectangle

with-dither [Macro]

Summary   Specifies a dither for use within a specified body of code.

Package   graphics-ports

Signature  with-dither (dither-or-size) &body body => result

Arguments  dither-or-size See Description.
body       A body of Lisp code.

Values     result The return value of the last form executed in body.

Description The macro with-dither specifies a dither for use within body. The dither-or-size argument can be a dither mask object from make-dither or a size, in which case a dither of that size is created.

Notes   with-dither is deprecated. Dithers do not affect drawing or anti-aliasing.
See also
dither-color-spec
make-dither
initialize-dithers

with-graphics-mask

Macro

Summary
Binds the mask slot of a port’s graphics state across the execution of a body of code.

Package
graphics-ports

Signature
with-graphics-mask (port mask &key mask-x mask-y mask-transform) &body body => result

Arguments
port A graphics port.
mask nil or a list specifying a shape.
mask-x An integer. This argument is deprecated.
mask-y An integer. This argument is deprecated.
mask-transform nil, t, the keyword :dynamic, or a transform.
body A body of Lisp code.

Values
result The return value of the last form executed in body.

Description
The macro with-graphics-mask binds the mask slot of port’s graphics-state while evaluating body. The mask can be a rectangular area specified by a list of the form (x y width height) or a path specified by a list of the form (:path path :fill-rule fill-rule).

mask-x and mask-y are deprecated. They work only when the drawing-mode is :compatible and the platform is GTK+ or X11/Motif. By default, mask-x and mask-y are both 0.
The `mask-transform` argument is used to set the `mask-transform` graphics state parameter. If `mask-transform` is `nil`, then the `mask` is not transformed. If `mask-transform` is `t`, then the `mask` is transformed by the current graphics state transform at the time that `with-graphics-mask` is used. If `mask-transform` is `:dynamic`, then the `mask` is transformed by the graphics state transform that is in effect when the drawing operation uses the mask. Otherwise `mask-transform` should be a transform object. The default value of the `mask-transform` argument is `nil`.

Notes
See `graphics-state` for more details about `mask` and `mask-transform`.

Examples
This example file demonstrates the use of `mask-transform`:

```lisp
(exexample-edit-file "capi/graphics/paths")
```

See also
`graphics-state`
“Graphics state” on page 211

`with-graphics-post-translation`

**Macro**

Summary
Like `with-graphics-translation` except that the translation is done after applying all existing transforms.

Signature
`with-graphics-post-translation (port dx dy) &body body => result`

Arguments
- `port` A graphics port.
- `dx` A real number.
- `dy` A real number.
- `body` Lisp forms.

Values
- `result` The value returned by the last form of `body`. 
The macro `with-graphics-post-translation` is the same as `with-graphics-translation`, but the translation is done after applying all existing transforms. That means that the translation is "absolute", not transformed. In contrast, when using `with-graphics-translation` the translation is transformed by any existing transform(s).

This form draws a 40x40 rectangle at (100,100), because the scale is applied to the coordinates of the rectangle, but not to the translation.

```lisp
(gp:with-graphics-scale (port 2 2)
  (gp:with-graphics-post-translation (port 1 0 0 100 100)
    (gp:draw-rectangle port 0 0 20 20)))
```

Compare with this form, using `with-graphics-translation` instead, which draws a 40x40 rectangle at (200,200), because the scale applies to the translation too:

```lisp
(gp:with-graphics-scale (port 2 2)
  (gp:with-graphics-translation (port 100 100)
    (gp:draw-rectangle port 0 0 20 20)))
```

See also `with-graphics-transform-reset`

`with-graphics-translation`

"Setting the graphics state" on page 211

---

**with-graphics-rotation**

**with-graphics-scale**

**with-graphics-translation**

### Macros

**Summary**

Combines a transformation (rotation, scaling or translation) with the transform of a port for the duration of the macro.

**Package**

`graphics-ports`

**Signature**

```
with-graphics-rotation (port angle) &body body => result
with-graphics-scale (port sx sy) &body body => result
```
with-graphics-translation (port dx dy) &body body => result

**Arguments**
- *port* A graphics port.
- *angle* A real number.
- *sx, sy* Real numbers.
- *dx, dy* Real numbers.
- *body* A body of Lisp code.

**Values**
- *result* The return value(s) of the last form executed in *body*.

**Description**
These macros combine the transform associated with the graphics port with an additional transform during the body of the macro. The port is given a new transform obtained by pre-multiplying its current transform with the transform that the macro creates.

- **with-graphics-rotation** creates a transformation that rotates with *angle* radians. If *angle* is positive, then the rotation is clockwise.

- **with-graphics-scale** creates a transformation that scales by *sx* and *sy* in the X and Y dimensions.

- **with-graphics-translation** creates a transformation that translates by *dx* and *dy* in the X and Y dimensions.

**Notes**
1. These macros do the same as **with-graphics-transform** does with an appropriate transform.
2. The transform associated with a graphics port is part of the port’s graphics state. See **graphics-state** for details.

**Examples**
(example-edit-file "capi/graphics/catherine-wheel")
See also graphics-state
      with-graphics-post-translation
      with-graphics-transform
      “Graphics state transforms” on page 213
      “Setting the graphics state” on page 211

with-graphics-state

Macro

Summary
Binds the graphics state values of a port to a list of arguments
and executes a body of code.

Package
graphics-ports

Signature
with-graphics-state (port &rest args &key transform
  foreground background operation thickness scale-thickness dashed
dash line-end-style line-joint-style mask font state fill-style stipple
  pattern mask-x mask-y shape-mode text-mode compositing-mode
  mask-transform) body => result

Arguments
  port  A graphics port.
  body  A body of Lisp code.

Values
  result  The return value of the last form executed in
          body.

Description
The macro with-graphics-state binds the graphics state
values for the specified port to the values specified in the args
list. The keyword arguments args correspond to the slots in
the graphics state, as described in graphics-state.

For example:

(with-graphics-state (port :thickness 12 :foreground my-color) ...)

Arguments that are not supplied default to the current state
of that slot in the graphics-state. The argument stipple is
used only on X11/Motif.
mask-x and mask-y are deprecated. They work only when the
drawing-mode is :compatible and the platform is GTK+ or
X11/Motif.

An extra keyword argument :state can be used. The value
must be a graphics-state object created by a call to make-
graphics-state. The contents of the graphics-state
object passed are used instead of the port’s state.

Example

(setf gstate (make-graphics-state))
(setf (graphics-state-foreground gstate) my-color)
(with-graphics-state (port :state gstate)
  (draw-rectangle port image-1 100 100))

See also

  graphics-state
  set-graphics-state
  with-graphics-translation
  with-graphics-post-translation
  with-graphics-scale
  with-graphics-rotation
  with-graphics-transform
  with-graphics-transform-reset
  with-graphics-mask

Chapter 13, “Drawing - Graphics Ports”

with-graphics-transform

  Macro

Summary

  Combines a given transform with the transform of a port for
  the duration of the macro.

Package

  graphics-ports

Signature

  with-graphics-transform (port transform) &body body =>
  result

Arguments

  port

A graphics port.
transform  A transform.

body  A body of Lisp code.

Values  
result  The return value of the last form executed in body.

Description  The macro with-graphics-transform combines the transform associated with the graphics port port with transform during the body of the macro. The port is given a new transform obtained by pre-multiplying its current transform with transform. This has the effect of preceding any translation, scaling and rotation operations specified in the body of the macro by those operations embodied in transform.

Notes  See graphics-state for details of how a transform is used.

Examples  
(example-edit-file "capi/graphics/metafile-rotation")

See also  graphics-state
transform

with-graphics-transform-reset  

Macro

Summary  Like with-graphics-transform except that it ignores existing transforms.

Signature  
with-graphics-transform-reset (port &optional transform)
&body body => result

Arguments  
port  A graphics port.
transform  A transform.
body  Lisp forms.

Values  
result  The value returned by the last form of body.
| Description | The macro `with-graphics-transform-reset` works the same as `with-graphics-transform` except that it ignores existing transforms.

If the argument `transform` is `nil`, the `body` is applied without transform (that is, with the unit transform).

| Examples | This form ignores the translation, and applies only the explicit transform (which is really just scale), so that the overall effect is to draw a 30x20 rectangle at (0,0).

```
(gp:with-graphics-translation (port 100 100)
  (gp:with-graphics-transform-reset (port (gp:make-transform 3 0 0 2 0 0 ))
    (gp:draw-rectangle port 0 0 10 10)))
```

Compare with using `with-graphics-transform`, which applies both the translation and the explicit transform, so that the overall effect is to draw a rectangle 30x20 at (100,100).

```
(gp:with-graphics-translation (port 100 100)
  (gp:with-graphics-transform (port (gp:make-transform 3 0 0 2 0 0 ))
    (gp:draw-rectangle port 0 0 10 10)))
```

| See also | `with-graphics-post-translation`

| `with-inverse-graphics` | **Macro**

| Summary | Executes all drawing function calls to a given port within the body of the macro with `foreground` and `background` colors swapped.

| Package | `graphics-ports`

| Signature | `with-inverse-graphics (port) &body body => result`

| Arguments | `port` A graphics port. |
**body**  
A body of Lisp code.

**Values**  
**result**  
The return value of the last form executed in *body*.

**Description**  
The macro `with-inverse-graphics` ensures that all drawing function calls to `port` within the body of the macro are executed with the *foreground* and *background* slots of the *graphics-state* of `port` swapped.

---

**with-pixmap-graphics-port**  
**Macro**

**Summary**  
Binds a port to a new pixmap graphics port for the duration of the macro’s code body.

**Package**  
`graphics-ports`

**Signature**  
```lisp
with-pixmap-graphics-port (port pane width height &key background collect relative clear drawing-mode) &body body) => result
```

**Arguments**
- **port** A graphics port.
- **pane** An output pane.
- **width** An integer.
- **height** An integer.
- **background** A color keyword.
- **collect** A boolean.
- **relative** A boolean.
- **clear** A list or `t`.
- **drawing-mode** One of the keywords `:compatible` and `:quality`.
- **body** A body of Lisp code.
Values  

| result | The return value of the last form executed in body. |

Description  
The macro `with-pixmap-graphics-port` binds `port` to a new pixmap graphics-port. `pane` and the other arguments are passed to `create-pixmap-port`. The body is then evaluated. The port is destroyed when `body` returns. The background and foreground default to the values in the graphics state of `pane`.  

Example  
In the code below the background in `p2` inherits from `p1`, so it draws two green rectangles.  

```
(let ((op (capi:contain  
            (make-instance 'capi:output-pane  
              :background :red)))  
      (sleep 0.1)  
      (gp:with-pixmap-graphics-port (p1 op 20 30  
                                    :background :green  
                                    :clear t)  
        (gp:copy-pixels op p1 10 10 20 30 0 0)  
        (gp:copy-pixels op p2 10 60 20 30 0 0)))  
```

See also  
Chapter 13, “Drawing - Graphics Ports”

with-transformed-area  

Macro  

Summary  
Transforms a rectangle using a port’s transform, and binds the resulting values to a variable across the evaluation of the macro’s body.  

Package  
`graphics-ports`

Signature  
`with-transformed-area (points port left top right bottom) &body body`

Arguments  
points  
A variable.  
port  
A graphics port.
**with-transformed-area**

**Values**

- **result**: The return value of the last form executed in **body**.

**Description**
The macro `with-transformed-area` transforms a rectangle, binding the resulting four corner points to **points** for the duration of **body**. The left top right bottom values represent a rectangular area bounded by four points. The four points are transformed by the port's transform and the list of eight values (alternating x and y values for four points) bound to the **points** variable for the duration of the macro body.

---

**with-transformed-point**

**Macro**

**Summary**
Binds a point transformed by a given ports transform to two variables across the body of the macro.

**Package**
`graphics-ports`

**Signature**

```
(with-transformed-point (new-x new-y port x y) &body body => result)
```

**Arguments**

- **new-x**: A variable.
- **new-y**: A variable.
- **port**: A graphics port.
- **x**: A real number.
- **y**: A real number.
**body**  
A body of Lisp code.

**Values**  
**result**  
The return value of the last form executed in **body**.

**Description**  
The macro **with-transformed-point** transforms the point given by \((x \ y)\) using the **port**'s transform and the resulting values are bound to the **new-x** and **new-y** variables. The **body** of the macro is then evaluated with this binding.

### with-transformed-points

**Macro**

**Summary**  
Binds a list of transformed points in a port to a list across the execution of the macro’s body.

**Package**  
**graphics-ports**

**Signature**  
**with-transformed-points** \((points \ port) \ \&\text{body} \ body \Rightarrow result\)

**Arguments**  
**points**  
A list of real numbers.

**port**  
A graphics port.

**Values**  
**result**  
The return value of the last form executed in **body**.

**Description**  
The macro **with-transformed-points** binds **points** to a new list of \(x\) and \(y\) values obtained by post-multiplying them by the current transform of **port**, and then evaluates **body**. The **points** symbol must be bound to a list of alternating \(x\) and \(y\) values representing coordinate points in the **port**.
with-transformed-rect

Macro

Summary
Transforms the coordinates of a rectangle and binds them to variables while executing a body of code.

Package graphics-ports

Signature
with-transformed-rect (nx1 ny1 nx2 ny2 port x1 y1 x2 y2)
&body body => result

Arguments
nx1 A variable.
ny1 A variable.
x2 A variable.
ny2 A variable.
port A graphics port.
x1 A real number.
y1 A real number.
x2 A real number.
y2 A real number.
body A body of Lisp code.

Values
result The return value of the last form executed in body.

Description
The macro with-transformed-rect transforms the coordinates of a rectangle and binds them to four variables for the duration of the macro’s body.

During the evaluation of the body of the macro with-transformed-rect, the two points (x1, y1) and (x2, y2) are transformed by the port’s current transform and the resulting values are bound to the variables named by the arguments nx1 ny1 nx2 and ny2.
without-relative-drawing

**Macro**

**Summary**
Evaluates a body of Lisp code with the `relative` and `collect`
internal variables of the port set to `nil`.

**Package**
`graphics-ports`

**Signature**
`without-relative-drawing (port) &body body => result`

**Arguments**
- `port` A graphic port.
- `body` A body of Lisp code.

**Values**
- `result` The return value of the last form executed in
`body`.

**Description**
The macro `without-relative-drawing` evaluates the code in
`body` with the `relative` and `collect` internal variables of the
pixmap graphics port `port` set to `nil` to turn off the port’s col-
lecting of drawing bounds and automatic shifting of its ori-
gins. Use this macro only within a `with-pixmap-graphics-
port` macro.

write-external-image

**Function**

**Summary**
Writes external image data to a file.

**Package**
`graphics-ports`

**Signature**
`write-external-image external-image destination &key if-exists`

**Arguments**
- `external-image` An `external-image`.
- `destination` A pathname designator.
- `if-exists` A keyword.
Description  The function `write-external-image` writes an external image to `destination`. If `destination` is a stream, it must be an output stream with element type compatible with `(unsigned-byte 8)`, that is one of `cl:base-char`, `(signed-byte 8)` and `(unsigned-byte 8)`. If `destination` is a pathname or namestring the file is opened for output with the correct element type, and `write-external-image` writes the bytes to the resulting stream as if by `cl:write-sequence`.

`if-exists` is passed to `open` when opening `file`. The default value of `if-exists` is `:error`.

See also  `externalize-image`

“External images” on page 221
This chapter provides reference entries for the symbols exported from the `lw-gt` package. This package is for the Graphic Tools, which are interfaces which use Graphics Ports and CAPI. These contain the drawing objects, which add a mechanism to creates a hierarchy of drawing, when a "drawing" is (typically) a simple Graphics Ports drawing operation. The hierarchy specifies the geometry of each node in the hierarchy, so the whole group drawings can be manipulated as a single object.

To use Graphic Tools, you first need to load the module "graphic-tools", like this:

```
(require "graphic-tools")
```

See Chapter 14, “Graphic Tools drawing objects” for an overview of Graphic Tools.

apply-drawing-object  

Class

Summary  
A drawing-object that applies a supplied function to supplied arguments.

Package  
lw-gt

Superclasses  
drawing-object

Subclasses  
None.

Accessors  
None.

Description  
The class apply-drawing-object is a drawing-object that applies a supplied function to a list of supplied arguments, normally preceded by the objects-displayer. Its main usage is for doing the actual drawing.

apply-drawing-objects can be used repeatedly and concurrently in the same or different panes. The ones that are created by the make-draw-* functions (make-draw-arc and so on) are fixed, but for objects created by make-a-drawing-call, the supplied function may depend on values that change, and hence needs to be redisplayed when these values change. Use force-objects-redraw on the root of the hierarchy (an objects-displayer or a pinboard-objects-displayer) to do that.

See drawing-object for description of the drawing operation.

See also  
objects-displayer  
pinboard-objects-displayer  
position-object  
fit-object  
position-and-fit-object
**basic-graph-spec**

*Structure class*

**Summary**

Provides a mechanism to simplify generating a graph of a mathematical function which maps x to y.

**Package**

lw-gt

**Accessors**

- basic-graph-spec-function
- basic-graph-spec-start-x
- basic-graph-spec-step-x
- basic-graph-spec-range
- basic-graph-spec-color
- basic-graph-spec-thickness
- basic-graph-spec-name
- basic-graph-spec-x-scale
- basic-graph-spec-y-scale
- basic-graph-spec-x-offset
- basic-graph-spec-y-offset
- basic-graph-spec-var1
- basic-graph-spec-var2
- basic-graph-spec-var3
- basic-graph-spec-var4
- basic-graph-spec-var5
- basic-graph-spec-var6

**Description**

The structure class `basic-graph-spec` provides a mechanism to simplify generating a graph of a mathematical function which maps x to y. Create it with `make-basic-graph-spec`.

**Notes**

1. The `basic-graph-spec` mechanism is intended to make it simpler to repeatedly compute graphs for a function with values that may change. It is a thin layer, and you can implement your own version using `generate-graph-from-pairs`.

2. `basic-graph-spec` is a structure type, and can be included in structures your define to extend the functionality.
See also  make-basic-graph-spec
“Higher level - drawing graphs and bar charts” on page 236

compound-drawing-object

Summary  A drawing-object that draws the "child" drawing-object in its sub-object slot.

Package  lw-gt

Superclasses  drawing-object

Subclasses  geometry-drawing-object

Accessors  compound-drawing-object-sub-object
            compound-drawing-object-data

Description  The class compound-drawing-object is a drawing-object that has a "child" drawing-object in its sub-object slot. The compound-drawing-object draws the "child".

The main usage of compound-drawing-object is through its subclass geometry-drawing-object, which manipulates the geometry around drawing the objects. See geometry-drawing-object.

It is possible to set the sub-object slot in a compound-drawing-object using (setf compound-drawing-object-sub-object). This can be done on any thread. This setting does not cause automatic redisplay of the object. The redisplay happens next the time the hierarchy is redisplayed. You can force the redisplay by calling force-objects-redraw.

compound-drawing-object should not be made by cl:make-instance. See geometry-drawing-object for how to make it.
The accessor `compound-drawing-object-data` can be used to read and set the `data` slot in the `compound-drawing-object`. You can use the `data` slot to store related information, and it is used by `compute-drawing-object-from-data`.

See also

- `objects-displayer`
- `pinboard-objects-displayer`
- "Lower level - drawing objects and objects displayers" on page 229

**compute-drawing-object-from-data**

**recurse-compute-drawing-object**

*Functions*

**Summary**

Use the `function` and/or `data` in `compound-drawing-objects`.

**Package**

`lw-gt`

**Signatures**

```
compute-drawing-object-from-data compound-drawing-object => result
```

```
recurse-compute-drawing-object object
```

**Arguments**

- `compound-drawing-object`
  
  A `compound-drawing-object`.

- `object`
  
  An `objects-displayer`, `pinboard-objects-displayer`, a list, or a `compound-drawing-object`.

**Values**

- `result`
  
  A boolean.

**Description**

The function `compute-drawing-object-from-data` does something only when it is applied to a `compound-drawing-object`, otherwise it just returns `nil`. When the object is a `compound-drawing-object`, `compute-drawing-object-from-data` checks if the object has either `function` or `data` non-nil. For the object to have a non-nil `function`, this must have
been supplied when it was created (for example when creating `geometry-drawing-object`). The `data` can be passed in creation or set later by `(setf compound-drawing-object-data)`.

If the object has a non-nil `function`, `compute-drawing-object-from-data` calls it with `data` as a single argument, and uses the result. Otherwise, if the object has a non-nil `data`, `compute-drawing-object-from-data` calls the generic function `get-drawing-object` with `data` as a single argument, and uses the result. If this result is `:no-change`, `compute-drawing-object-from-data` just returns nil. `get-drawing-object` has a default method that returns `:no-change`.

Otherwise, the result must be a "drawing-object-spec", which means either an instance of (a subclass of) `drawing-object` or a list of "drawing-object-specs". `compute-drawing-object-from-data` then sets the `sub-object` of the object to the result, and returns `t`.

The argument `object` to `recurse-compute-drawing-object` should be an `objects-displayer`, a `pinboard-objects-displayer`, a list, or a `compound-drawing-object`. For other objects `recurse-compute-drawing-object` just returns nil.

`recurse-compute-drawing-object` recurses the hierarchy under `object`, and for each `compound-drawing-object` that it finds calls `compute-drawing-object-from-data`.

When the argument is either an `objects-displayer` or `pinboard-objects-displayer`, `recurse-compute-drawing-object` also calls `force-objects-redraw` when it finishes.

These functions can be called on any thread.

**Notes**

1. The purpose of these functions is to allow creating a tree of `drawing-objects` that can update itself, by passing the `function` argument when making it or defining `get-draw-
ing-object and passing the appropriate data. Then the tree can be told to recompute itself by calling recurse-compute-drawing-object.

2. These functions do not cause redraw, except when recurse-compute-drawing-object is applied to objects-displayer or pinboard-objects-displayer. You will have to do it yourself by using force-objects-redraw on the root of the hierarchy or hierarchies which need redrawing.

3. recurse-compute-drawing-object does not check against duplication, so if the same object appears in the hierarchy more than once, it will be updated repeatedly.

See also geometry-drawing-object
compound-drawing-object
“Lower level - drawing objects and objects displayers” on page 229

drawing-object

Class

Summary The root class for drawing objects.

Package lw-gt

Superclasses None.

Subclasses compound-drawing-object
apply-drawing-object
string-drawing-object

Indirect sub-class geometry-drawing-object
Description

The class `drawing-object` is the root class for drawing objects, which are used to create hierarchies of drawings. The hierarchy is made of `compound-drawing-object` objects, which group other drawing objects and affect their geometry, lists of `drawing-objects`, and leaf drawing objects (currently `apply-drawing-object` and `string-drawing-object`), which actually do the drawing.

A `drawing-object` is part of the hierarchy when it is in the `drawing-object` slot of an `objects-displayer` or a `pinboard-objects-displayer`, or it is inside a list which is in a hierarchy, or it is in the `sub-object` slot of a `compound-drawing-object`. The root of the hierarchy is always an `objects-displayer` or a `pinboard-objects-displayer`. A node in the hierarchy (except the root) is either a `drawing-object` or a list, which is collectively called "drawing-object-spec". In a list all the elements must be "drawing-object-specs".

`drawing-object` can concurrently appear multiple times in the same or different hierarchies, in the same or different panes and same or different interfaces.

Drawing `drawing-objects` is always done top-down: the root object draws its `drawing-object`. Typically this is either a `compound-drawing-object` or a list, which will draw their `sub-object` or elements respectively. Each object which is a `geometry-drawing-object` does something to the geometry, that is set up some Graphics Ports transformation, and then draw all its objects inside this context. For lists the elements are drawn in the same context in which the list is drawn. Leaf `drawing-objects` actually draw something.

**parent, root, and root pane**

When the drawing operation reaches a `drawing-object`, it is because it is inside the hierarchy inside a `compound-drawing-object` or directly inside the hierarchy under an `objects-displayer` or a `pinboard-objects-displayer`. This `compound-drawing-object`, `objects-displayer` or
pinboard-objects-displayer is the "parent" of the drawing-object for this drawing operation, and determines its geometry. During the drawing operation there is also the "root" (the objects-displayer or pinboard-objects-displayer from which the drawing started), and the "root pane" (the objects-displayer when the root is an objects-displayer, or the pane of the pinboard-objects-displayer).

Note that "parent", "root" and "root pane" of a drawing-object are transient concepts, and are applicable only inside the context of a drawing operation of the drawing-object. The same drawing-object may be drawn many times, with (potentially) different "parent", "root" and "root pane". It can be even drawn concurrently with different "root panes".

Notes drawing-objects should not be made by cl:make-instance. See the entries for the subclasses for how to make them.

See also objects-displayer
pinboard-objects-displayer
"Lower level - drawing objects and objects displayers" on page 229

fit-object
make-absolute-drawing
make-absolute-drawing*
position-object
position-and-fit-object
rotate-object

Functions

Summary Create a geometry-drawing-object, where the sub-object is the drawing-object.

Package lw-gt
Signatures

fit-object drawing-object intended-width intended-height &key
data function => geometry-drawing-object

make-absolute-drawing (&rest drawing-objects) => geometry-
drawing-object

make-absolute-drawing* (drawing-object) => geometry-drawing-
object

position-object drawing-object &key left-margin left-ratio right-
margin right-ratio top-margin top-ratio bottom-margin bottom-ratio
data function => geometry-drawing-object

position-and-fit-object drawing-object intended-width
intended-height &key left-margin left-ratio right-margin right-ratio
top-margin top-ratio bottom-margin bottom-ratio data function =>
geometry-drawing-object

rotate-object drawing-object angle &key left-margin left-ratio
bottom-margin bottom-ratio data function => geometry-drawing-
object

Arguments
drawing-object A "drawing-object-spec".

Values
geometry-drawing-object A geometry-drawing-object.

Description
The functions fit-object, make-absolute-drawing, make-
absolute-drawing*, position-object, position-and-
fit-object and rotate-object are the "geometry" func-
tions. Each creates a geometry-drawing-object, where the
sub-object slot contains drawing-object.

Each drawing-object argument must be a "drawing-object-
spec", which means either an instance of (a subclass of) draw-
ing-object or a list of "drawing-object-specs".

**position-object**

When drawing, the geometry-drawing-object created by
position-object computes its own position and size based
on the keyword arguments and the position and size of its
parent (see drawing-object for the meaning of "parent"). It
then establishes a Graphics Ports translation to translate from its parent's left/bottom corner to its own left/bottom corner, and draws its sub-object.

The keyword arguments to position-object specify how to compute the left, right, bottom and top of the positioning object with respect to its parent. For each side, the value is computed by multiplying the ratio by the relevant dimension (width for left and right, height for top and bottom), and then add (for left and bottom) or subtract (for right and top) the margin. Note that the vertical coordinate is 0 at the bottom and increases towards the top.

The default values of right-ratio and top-ratio are 1, and the default values of all the other keyword arguments are 0, making it compute the same position and size as the parent.

Notes

1. The width and height of a positioning object are not used explicitly, but will be used by any child object that is itself a geometry-drawing-object.

2. A positioning geometry-drawing-object does not cause any scaling.

3. Calling position-object without passing right and top values is a useful way to just shift objects around, but the resulting width and height are probably not useful. If the drawing-object contains drawing objects that need the width and height (result of fit-object, position-and-fit-object, or rotate-object), you probably need to set the right and top too.

fit-object

When drawing, the geometry-drawing-object created by fit-object computes scaling factors for the horizontal and vertical dimensions by dividing its width and height, which it inherits from its parent, by its intended-width and intended-height. It then establishes a Graphics Ports scaling transformation with these factors, and draws its sub-object.
position-and-fit-object

**position-and-fit-object** creates a *drawing-object* that performs the equivalent of using *position-object* with the result of *fit-object* on the *drawing-object* argument. In other words, it first positions and then fits.

rotate-object

When drawing, the *geometry-drawing-object* created by *rotate-object* computes the transform for rotating the object around the point specified by the keyword arguments (default to left-bottom corner). *left-margin, left-ratio, bottom-margin* and *bottom-ratio* are used to compute the center of rotation, using the same algorithm as in *position-object*.

*rotate-object* does not affect the width and height of the drawing, but since the drawing itself is rotated, the direction in which the width and height apply are rotated too. For example, if you rotate by \(\pi/2\), the width is in the vertical dimension on the screen.

make-absolute-drawing

**make-absolute-drawing** creates an object that displays its objects in "absolute mode", which means drawing without scaling or rotation, but still taking account of the translation. When using a metafile, the absolute drawing is into the metafile. When the metafile is drawn, it normally scales and this scales everything, including absolute drawings.

**Notes**

1. Inside the "absolute" scope, the y increases downwards rather than upwards.

2. An example where absolute drawing is useful is drawing of strings and some associated *drawing-objects* inside a larger object, where you want to allow the larger object to
scale and rotate and the strings displayed in the correct place, but you want the strings to be upright and optimal size for readability.

**data and function**

The *data* argument can be anything, and is stored in the `geometry-drawing-object`, and can be accessed by `compound-drawing-object-data`. It can be used to keep arbitrary data, and is also used by `compute-drawing-object-from-data`.

The *function* argument is used by `compute-drawing-object-from-data` only. See `compute-drawing-object-from-data`.

`geometry-drawing-object` objects can be used repeatedly and concurrently in the same or different panes. The *sub-object* can be changed dynamically by using `(setf compound-drawing-object-sub-object)` from any thread, but if it is already being displayed, you will need to ensure that they are redrawn. See `force-objects-redraw`.

See also

drawing-object
compound-drawing-object
objects-displayer
pinboard-objects-displayer
force-objects-redraw

“Lower level - drawing objects and objects displayers” on page 229

**force-objects-redraw**  

*Function*

Summary  
Forces redrawing of objects.

Package  
`lw-gt`
Signature  
force-objects-redraw pane

Arguments  
pane  An objects-displayer or a pinboard-objects-displayer.

Description  
The function force-objects-redraw forces redrawing of the objects in the drawing-object slot of pane.

pane should be either an objects-displayer or a pinboard-objects-displayer. When force-objects-redraw is called on any other object it silently does nothing.

force-objects-redraw uses apply-in-pane-process, so can be used on any process.

Notes  
In the case of objects-displayer, force-objects-redraw forces redrawing of the drawing-object of the objects-displayer and the drawing-objects and any pinboard-objects-displayer objects in the description of the objects-displayer, but does not force redraw of other pinboard-objects. force-objects-redraw is needed when you set the sub-object slot in any of the drawing-objects inside a hierarchy, because setting does not cause automatic redrawing.

See also  
objects-displayer
pinboard-objects-displayer
“Lower level - drawing objects and objects displayers” on page 229

generate-bar-chart  
Function

Summary  
Generate a list of drawing-objects which display the bars of a bar chart.

Package  
1w-gt
### Signature

```
**generate-bar-chart** values &key function start-position step-position width orientation colors title-position argument font base title-color absolute-p => bars
```

### Arguments

- **values**: A list.
- **function**: A function of one or two arguments, depending on **argument**.
- **start-position**: The position of the first bar.
- **step-position**: The distance between bars.
- **width**: The width of a bar.
- **orientation**: One of the keywords `:rightward`, `:leftward`, `:downward` and `:upward`.
- **colors**: A list of colors.
- **title-position**: One of the keywords `:middle`, `:top`, `:bottom`, `:right` and `:left`, or nil.
- **argument**: A Lisp object.
- **font**: A font specification.
- **base**: The position of the "base" of each bar.
- **title-color**: A color specification.
- **absolute-p**: A boolean.

### Values

- **bars**: A list of **drawing-objects**.

### Description

The function **generate-bar-chart** generates a list of **drawing-objects** which display the bars of a bar chart.

*values* is a list giving the values that need displaying. There is a bar for each element in the list.

For each element in **values**, **generate-bar-chart** uses the function **function** to find the length of the bar and a title to add to it. If **argument** is non-nil, **function** is called with two arguments: **argument** and the element of **values**. Otherwise,
function is called with one argument, the element. function must return the length of the bar, and optionally the title as a second return value. The default value of argument is nil.

If function is not supplied, the default function checks if the element is a list, and if it is returns the first element of it as the length and the second element as the title. If it is not a list it returns it and nil as the second value.

generate-bar-chart then generates a drawing-object that draws the bar, which is a rectangle with length being the result of the function and width the width argument. The default value of width is 1.

For orientation :upward or :downward, the "length dimension" is vertical, and the "width" dimension is the horizontal, and the reverse for the other orientations. The default value of orientation is :upward.

The position of the rectangle in the "length dimension" is from base to (+ base length) for orientation :upward and :leftward, and from base to (- base length) for the other orientations. The default value of base is 0.

start-position and step-position determine the position of the center of the rectangle in "width dimension". Hence the position of the n’th rectangle in the "width dimension" is from

\[- (+ (start-position (* (1- n) step-position)) (/ width 2))\]

to

\[ (+ (start-position (* (1- n) step-position)) (/ width 2))\]

The default value of start-position is 1. The default value of step-position is (* 3 width).

The color of the rectangle is taken from the colors list in turn, starting from the beginning when reaching the end. The default value of colors is (:red :green :blue :yellow :purple).
\textbf{generate-bar-chart} then also computes where the string should appear with respect to the bar, depending on \textit{title-position}, generates a drawing object using \texttt{make-draw-string}, passing it the \textit{font}, \textit{absolute-p} and \textit{title-color}. \textit{title-position nil} means the end of the bar. The default value of \textit{font} is the font of the pane. \textit{absolute-p} determines whether the title is drawn in absolute mode. The default value of \textit{absolute-p} is \texttt{t}.

See also \texttt{drawing-object}
“Lower level - drawing objects and objects displayers” on page 229

\textbf{generate-graph-from-pairs} \hfill \textit{Function}

\textbf{Summary} Generates a drawing object which draws lines connecting points.

\textbf{Package} lw-gt

\textbf{Signature} \texttt{generate-graph-from-pairs x-y-pairs &key thickness color x-offset y-offset x-scale y-scale => drawing-object}

\textbf{Arguments} \begin{itemize}
\item \textit{x-y-pairs} A list.
\item \textit{thickness} A positive real number.
\item \textit{color} A Color specification.
\item \textit{x-offset, y-offset} Non-negative real numbers.
\item \textit{x-scale, y-scale} Positive real numbers.
\end{itemize}

\textbf{Values} \begin{itemize}
\item \textit{drawing-object} A \texttt{drawing-object}.
\end{itemize}

\textbf{Description} The function \texttt{generate-graph-from-pairs} generates a "graph", which is a drawing object which draws lines connecting the points in the \textit{x-y-pairs} argument.
x-y-pairs must be a list where each element is a list of length 2 specifying a point as a pair of coordinates (x, y).

x-scale, y-scale, x-offset and y-offset are used to scale and offset the graph. Each x value is multiplied by x-scale and then x-offset is added, and similarly for the y value. The default value of both x-offset and y-offset is 0. The default value of both x-scale and y-scale is 1.

The line is drawn with the thickness argument and color as the foreground color. The thickness is not scaled (it passes :scale-thickness nil to make-draw-lines). The default value of color is :red. The default value of thickness is 1.

Notes

generate-graph-from-pairs is a quite thin interface on top of make-draw-lines. If it does not do what you want, you can easily replace it by your own code.

See also

generate-graph-from-graph-spec
drawing-object
“Higher level - drawing graphs and bar charts” on page 236

---

**generate-grid-lines**

*Function*

**Summary**

Generate a grid of lines, to be used for drawing graphs of functions or bar charts.

**Package**

lw-gt

**Signature**

generate-grid-lines (&key x-offset y-offset x-spacing y-spacing horizontal-count vertical-count width height thickness major-x-step major-y-step vertical-thickness minor-thickness minor-vertical-thickness left-thickness right-thickness top-thickness bottom-thickness color vertical-color minor-color minor-vertical-color left-color right-color top-color bottom-color) => list

**Arguments**

horizontal-count, vertical-count

nil or positive integers.
width, height

   nil or positive real numbers.

x-offset, y-offset

   Non-negative real numbers.

x-spacing, y-spacing

   Positive real numbers.

major-x-step, major-y-step

   nil or integers.

thickness, vertical-thickness, minor-thickness, minor-vertical-thickness, left-thickness, right-thickness, top-thickness, bottom-thickness

   Positive real numbers. Each defaults to 1.

color, vertical-color, minor, minor-vertical-color, left-color, right-color, top-color, bottom-color

   Colors in the standard definition. Each defaults to :gray.

Values

   list

A list of drawing-objects.

Description

   The function generate-grid-lines generates a grid of lines, to be used for drawing graphs of functions or bar charts.

generate-grid-lines returns a list of drawing-objects which when drawn display a grid of horizontal and vertical lines, according to the supplied specification.

   The grid is made of vertical lines spaced regularly in the horizontal dimension, and horizontal lines spaced regularly in the vertical dimension. The specification of the graph is conceptual starting from 0 and increasing in both dimensions. This does not affect what values the graph shows, because these are defined by the labels which are produced separately (typically by generate-labels).
specify the offset of the origin of the graph, which means the position of the first vertical/horizontal line respectively, and where the start point of the horizontal/vertical line respectively. The default value of both \textit{x-offset} and \textit{y-offset} is 0.

\textit{x-spacing} and \textit{y-spacing} specify the gaps in the horizontal and vertical dimensions respectively (that is, the distance between vertical/horizontal lines). The default value of both \textit{x-spacing} and \textit{y-spacing} is 1.

\textit{horizontal-count} and \textit{vertical-count} specify the numbers of lines in the horizontal and vertical dimensions respectively (that is, the number of vertical / horizontal lines).

The length of the horizontal (vertical) lines is computed by the product \textit{x-spacing} \* \textit{horizontal-count} (\textit{y-spacing} \* \textit{vertical-count}).

\textit{width} and \textit{height} are used only when \textit{horizontal-count} / \textit{vertical-count} respectively is \texttt{nil}, to compute the value of the \textit{horizontal-count} / \textit{vertical-count}, by truncating the \textit{width} / \textit{height} by the \textit{x-spacing} / \textit{y-spacing}.

\textit{major-x-step} and \textit{major-y-step} specify that each \textit{major-x-step}'th (horizontally) or \textit{major-y-step}'th (vertically) line is "major", which means drawn with (potentially) different thickness and color (see below).

\textit{thickness} and the other \textit{*-thickness} arguments specify the thickness of the lines. \textit{color} and the other \textit{*-color} arguments specify the color of the lines. All the \textit{*-thickness} variables
default, directly or indirectly, to the value of thickness, and the 
*-color arguments default to the value of color. Table 23.1 gives 
the details:

Table 23.1 Default values for *-thickness and *-color arguments to
\texttt{generate-grid-lines}

<table>
<thead>
<tr>
<th>Argument</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>thickness</td>
<td>1</td>
</tr>
<tr>
<td>vertical-thickness</td>
<td>thickness</td>
</tr>
<tr>
<td>major-thickness</td>
<td>thickness</td>
</tr>
<tr>
<td>major-vertical-thickness</td>
<td>major-thickness</td>
</tr>
<tr>
<td>top-thickness</td>
<td>major-thickness</td>
</tr>
<tr>
<td>bottom-thickness</td>
<td>major-thickness</td>
</tr>
<tr>
<td>left-thickness</td>
<td>major-vertical-thickness</td>
</tr>
<tr>
<td>right-thickness</td>
<td>major-vertical-thickness</td>
</tr>
<tr>
<td>color</td>
<td>\texttt{gray}</td>
</tr>
<tr>
<td>vertical-color</td>
<td>color</td>
</tr>
<tr>
<td>major-color</td>
<td>color</td>
</tr>
<tr>
<td>major-vertical-color</td>
<td>major-color</td>
</tr>
<tr>
<td>top-color</td>
<td>major-color</td>
</tr>
<tr>
<td>bottom-color</td>
<td>major-color</td>
</tr>
<tr>
<td>left-color</td>
<td>major-vertical-color</td>
</tr>
<tr>
<td>right-color</td>
<td>major-vertical-color</td>
</tr>
</tbody>
</table>

The top-*, bottom-*, left-*, right-* variables specify the values 
for the outer lines of the grid. The major-* variables specify 
the values for the major lines, the other variables specify the
values for the ordinary lines. The `vertical-*` variables specify the values for the vertical lines, the other variables for the horizontal.

**Notes**

1. To actually be displayed, the result of `generate-grid-lines` must be in a hierarchy which is rooted in an `objects-displayer` or a `pinboard-objects-displayer`.

2. The result of `generate-grid-lines` is a list of `drawing-object`, so it is a valid "drawing-object-spec". It will be typically be grouped together with some other "drawing-object-specs", for example labels for the graph, by simply listing them, and then positioned and fitted by passing it to `position-object` or `fit-object` or `position-and-fit-object`.

3. The function `generate-labels` is intended to be useful to generate the labels.

4. `x-offset` and `y-offset` are useful for leaving space for the labels.

5. The units of the numbers that in the location of the lines are abstract, not pixels, and will typically correspond to the units of the data that the graph displays. They will be in pixels only if there is no fitting around the graph. For example, if you make the grid from 0 to 9 in the x dimension, and then fit to `natural-width` 10, that is you pass the result, or an object that contains the result in its hierarchy, to `fit-object` with the `natural-width` 10, the graph will take 90% of the width of the `geometry-drawing-object` that `fit-object` generated, whatever that is.

**See also**

- `drawing-object`
- `generate-graph-from-graph-spec`

"Higher level - drawing graphs and bar charts” on page 236
**generate-labels**

**Function**

**Summary**
Return the labels of a graph of a function.

**Package**
lw-gt

**Signature**
generate-labels horizontal-p start step range &key print-function decimal-point color x-adjust y-adjust absolute-p => labels

**Arguments**
- **horizontal-p** A boolean.
- **start** A real number.
- **step** A real number.
- **range** A positive real number.
- **print-function** nil, or a function of one argument which takes a real and returns a string.
- **decimal-point** An integer or nil.
- **color** A color specification in the Color system.
- **x-adjust, y-adjust** nil, a number, or one of the keywords :center and :end-align.
- **absolute-p** A boolean.

**Values**
- **labels** A list of drawing-objects.

**Description**
The function **generate-labels** returns a list of labels of **drawing-objects**, which are supposed to be the labels of a graph of a function.

**generate-labels** generates a list of drawing objects, which draw strings representing numbers and positioned in regular intervals in one dimension and fixed value in the other dimension.
horizontal-p specifies the dimension. When horizontal-p is true, the objects are placed in a row with regular horizontal intervals, otherwise they are spaced in a column with regular vertical intervals.

start determines the lowest value, range determines the range of values, and step determines the distance between neighbouring values. When step is negative, the start value is on the right (top) and the values increase from right to left (top to bottom).

For each value, generate-labels generates a string. If print-function is a function, it is called with the value and needs to return the string. Otherwise generate-labels uses

\[
\text{format \ nil "-.,vf" decimal-point value}\]

for generate-labels to generate the string. It then uses make-draw-string to generate a drawing-object, adjusting the position by x-adjust horizontally and y-adjust vertically and using color as the foreground color and make it "absolute mode" depending on absolute-p. It then positions the object (using position-object) at the right place. The default value of x-adjust is :center if horizontal-p is true, and :end-align otherwise. The default value of y-adjust is -1 if horizontal-p is true, and :center otherwise. The default value of color is :black.

generate-labels returns a list of drawing-objects, which is a valid "drawing-object-spec".

**Notes**

1. generate-labels will typically be used in conjunction with generate-grid-lines.
2. generate-labels is quite a simple function. If it does not do what you want, you can improve it easily by writing your own version.
3. The defaults for x-adjust and y-adjust are what you typically use when the labels are at the left and bottom of the graph. To put the labels somewhere else in the graph, use position-object on labels to move it around. If you
want the labels at the top, change \textit{y-adjust} to 0 when passing \textit{horizontal-p} true (so the labels are above the line), and then use \texttt{position-object} with \textit{bottom-margin} the height of the grid to move the whole row of labels:

\begin{verbatim}
(position-object (generate-labels ... :y-adjust 0)
    :bottom-margin grid-height)
\end{verbatim}

To move the column to the right, change \textit{x-adjust} to \texttt{nil} and use \texttt{left-margin}.

4. The size on the screen would normally be scaled by using \texttt{fit-object} on the result.

\textbf{See also} \texttt{fit-object}
\texttt{position-object}
\texttt{generate-grid-lines}
\texttt{drawing-object}
“Higher level - drawing graphs and bar charts” on page 236

\begin{description}
\item[\textbf{geometry-drawing-object}] \textit{Class}
\item[\textbf{Summary}] A \texttt{drawing-object} which when drawn changes the geometry of the drawing.
\item[\textbf{Package}] lw-gt
\item[\textbf{Superclasses}] \texttt{compound-drawing-object}
\item[\textbf{Subclasses}] None.
\item[\textbf{Accessors}] None.
\end{description}
The class **geometry-drawing-object** is a **drawing-object** which when drawn changes the geometry of the drawing by establishing a Graphics Ports transformation, and then draws the sub-object (slot inherited from **compound-drawing-object**) in this context.

See also **compound-drawing-object**

**make-a-drawing-call**
**make-draw-arc**
**make-draw-circle**
**make-draw-ellipse**
**make-draw-line**
**make-draw-lines**
**make-draw-polygon**
**make-draw-rectangle**

**Functions**

| Summary | Create and return an **apply-drawing-object**. |
| Package | lw-gt |
| Signatures | **make-a-drawing-call** function arguments &optional pass-pane-p => apply-drawing-object |
| | **make-draw-arc** x y width height start-angle sweep-angle &rest args => apply-drawing-object |
| | **make-draw-circle** x y radius &rest args => apply-drawing-object |
| | **make-draw-ellipse** x y x-radius y-radius &rest args => apply-drawing-object |
| | **make-draw-line** from-x from-y to-x to-y &rest args => apply-drawing-object |
| | **make-draw-lines** lines &rest args => apply-drawing-object |
| | **make-draw-polygon** points &rest args => apply-drawing-object |
make-draw-rectangle x y width height &rest args => apply-drawing-object

Arguments
See below.

Values
apply-drawing-object
An apply-drawing-object.

Description
Each of the functions make-a-drawing-call, make-draw-line, make-draw-lines, make-draw-polygon, make-draw-ellipse, make-draw-circle, make-draw-rectangle and make-draw-arc creates and returns an apply-drawing-object.

For make-a-drawing-call, the drawing is done by applying the function function to arguments. When pass-pane-p is true, function is applied to the "root pane" (see drawing-object) followed by arguments. function should typically draw something, but it does not have to, and may do other things. The default value of pass-pane-p is true.

For the other functions, the drawing is done using the corresponding Graphics Ports function:
make-draw-arc
draw-arc
make-draw-circle
draw-circle
make-draw-ellipse
draw-ellipse
make-draw-line
draw-line
make-draw-lines
draw-lines
make-draw-polygon
draw-polygon
**make-draw-rectangle**

**draw-rectangle**

The arguments for each of these functions are the same as the arguments of the corresponding Graphics Ports function (but the \( y \) is interpreted from the bottom, see below), excluding the first argument (\( pane \)).

Once created, the drawing object can be used in the `drawing-object` slot of an `objects-displayer` or a `pinboard-objects-displayer`, but more commonly it would be passed to one of the positioning/fitting functions (`position-object`, `fit-object` and so on), which will position and scale it with, by drawing the object inside a context of Graphics Ports transformation.

At the top level, the \( y \) coordinate is reversed, so the \( y \) argument is measured from the bottom of the `objects-displayer` or `pinboard-objects-displayer`, as opposed to the default which is from the top down. A fitting object in the hierarchy may change that.

`apply-drawing-objects` can be used repeatedly and concurrently in the same or different panes. The ones that are created by the `make-draw-\*` functions are fixed, but for objects created by `make-a-drawing-call`, the supplied function may depend on values that change, and hence needs to be redisplayed when these values change. Use `force-objects-redraw` on the root of the hierarchy (an `objects-displayer` or a `pinboard-objects-displayer`) to do that.

See `drawing-object` for description of the drawing operation.

**See also**

- `objects-displayer`
- `pinboard-objects-displayer`
- `position-object`
- `fit-object`
position-and-fit-object
“Lower level - drawing objects and objects displayers” on page 229

make-basic-graph-spec
basic-graph-spec-p
copy-basic-graph-spec
generate-graph-from-graph-spec

Functions

Summary
Create a basic-graph-spec object.

Package lw-gt

Signatures
make-basic-graph-spec function start-x step-x range &key color thickness name x-offset y-offset x-scale y-scale var1 var2 var3 var4 var5 var6 => basic-graph-spec
basic-graph-spec-p object
copy-basic-graph-spec graph-spec
generate-graph-from-graph-spec graph-spec

Arguments
function A function of two arguments x and y.
start-x
step-x
range
color
thickness
name
x-offset
y-offset
x-scale
y-scale
var1
var2
var3
var4
var5
var6

Values

basic-graph-spec  A basic-graph-spec object.

Description

The function make-basic-graph-spec creates a basic-graph-spec object. This object can be modified by the basic-graph-spec-* accessors. The function generate-graph-from-graph-spec generates the graph using the current values in the basic-graph-spec object, which is a drawing-object which when drawn draws the graph, which means drawing a line between each two successive points.

function must be a function of two arguments: the basic-graph-spec and the x value. It needs to return the corresponding y value.

start-x, step-x and range define which x values to use: the first value is start-x, and then increase by step-x until the x is greater than (+ start-x range). For each x value, generate-graph-from-graph-spec calls function with the graph-spec and the x value to generate the y value.

x-scale and y-scale (default to 1) are used to scale the x and y after calling function, by multiplying the x and y by x-scale and y-scale respectively.

x-offset and y-offset (default to 0) are used to translate the scaled values of x and y by adding the x-offset and y-offset to the scaled x and y.
The scaled and transformed pair \( x, y \) define a point. \texttt{generate-graph-from-graph-spec} then generates a \texttt{drawing-object} that draws a line between each two successive points. 

\textit{thickness} and \textit{color} specify the thickness and the color of the lines. The lines are drawn with \texttt{scale-thickness nil}.

\textit{name} and all the \texttt{varn} values are arbitrary values, which you can use to store anything that the function needs to compute the \( y \) value. The system does not read or write them.

The function \texttt{copy-basic-graph-spec} can be used to copy a \texttt{basic-graph-spec}. \texttt{basic-graph-spec-p} is the predicate.

See also

\begin{itemize}
  \item \texttt{basic-graph-spec}
  \item \texttt{generate-graph-from-pairs}
  \item \texttt{drawing-object}
  \item “Higher level - drawing graphs and bar charts” on page 236
\end{itemize}

\textbf{make-draw-string}

\textit{Function}

\textbf{Summary} Creates a \texttt{string-drawing-object}.

\textbf{Package} \texttt{lw-gt}

\textbf{Signature} \begin{verbatim}
make-draw-string string font-descriptor &rest arguments &key 
x-adjust y-adjust absolute &allow-other-keys) => string-
drawing-object
\end{verbatim}

\textbf{Arguments} 

\begin{itemize}
  \item \texttt{string} A string.
  \item \texttt{font-descriptor} A \texttt{font-description} object, an integer or \texttt{nil}.
  \item \texttt{absolute} A generalized boolean.
  \item \texttt{x-adjust, y-adjust} One of the keywords \texttt{:end-align} and \texttt{:center}, or a number.
\end{itemize}

\textbf{Values} \texttt{string-drawing-object} A \texttt{string-drawing-object}.
Description

The function `make-draw-string` creates a string-drawing-object, which draws the string using `draw-string`.

`string` is the string to draw.

`font-descriptor` can be a font-description specifying the font to use. It can also be an integer specifying the size only, which is equivalent to

\[
(gp:\text{make-font-description} \ :size \ font-descriptor)
\]

`font-descriptor` can also be `nil` meaning using the default font of the root pane.

When `absolute` is non-nil, the string is drawn in "absolute mode", which means ignoring scaling and rotation. The default value of `absolute` is `nil`.

`x-adjust` and `y-adjust` specify adjustment to the position of the string. The adjustments are done independently vertically and horizontally. The drawing point is the left/corner of the current geometry (inherited from the parent). If `x-adjust` and `y-adjust` are not supplied, the string is drawn at the drawing point. Note that this means that the descent part is below this point. If `x-adjust` and/or `y-adjust` are supplied, they can be one of:

- **:end-align** Align the "end" (right side or top) of the string with the drawing point.
- **:center** Align the center of the string with the drawing point.
- A number Multiply by the average width (`x-adjust`) or height (`y-adjust`) of the font and add to the drawing point.

Any other value of `x-adjust` or `y-adjust` is regarded as no adjustment. Adjustments are applied in the same scope as drawing the string, which means they are scaled or not depending on the value `absolute`. However, the y direction still increases upwards when computing the y adjustment.
arguments can also contain all the keyword arguments that draw-string takes, but :font is overridden by the font-descriptor argument.

See drawing-object about the drawing operation and the meaning of "parent" and "root pane".

See also drawing-object
“Lower level - drawing objects and objects displayers” on page 229

make-pinboard-objects-displayer Function

Summary Creates a pinboard-objects-displayer.

Package lw-gt

Signature make-pinboard-objects-displayer drawing-object &rest args &key use-metafile natural-width natural-height &allow-other-keys => pinboard-objects-displayer

Arguments drawing-object A "drawing-object-spec".
use-metafile A generalized boolean.
natural-width, natural-height Integers.

Values pinboard-objects-displayer

A pinboard-objects-displayer.

Description The function make-pinboard-objects-displayer creates a pinboard-objects-displayer, which is a subclass of pinboard-object. The pinboard-objects-displayer draws the drawing-object drawing-object.
**drawing-object** must be a "drawing-object-spec", which means either an instance of (a subclass of) **drawing-object** or a list of "drawing-object-specs".

**use-metafile** specifies whether to use an internal metafile. When **use-metafile** is true the **pinboard-objects-displayer** draws the objects to a metafile, and then draws the metafile to the screen. **natural-width** and **natural-height** determine the size of the metafile to use. They are ignored if **use-metafile** is false. The default value of **use-metafile** is **t**.

The default value of **natural-width** x **natural-height** is 800 x 600.

**args** can contain all the initargs of **pinboard-object**. In particular, all the geometry initargs can be used to define the initial geometry. The geometry can be changed later by **(setf capi:static-layout-child-geometry)** and the related functions.

See also

**drawing-object**

**objects-displayer**

**pinboard-objects-displayer**

“Lower level - drawing objects and objects displayers” on page 229

---

**objects-displayer**

**Class**

**Summary**

A subclass of **pinboard-layout**, which adds displaying of hierarchial objects.

**Package**

**lw-gt**

**Superclasses**

**pinboard-layout**

**Subclasses**

None.
Initargs

:drawing-object

A drawing-object or a list (see Description below).

:use-metafile

A generalized boolean.

:natural-width, :natural-height

Integers.

Accessors

objects-displayer-objects

Description

The class objects-displayer is a subclass of pinboard-layout that in addition to pinboard-objects can also have "drawing objects" which contain hierarchies of graphics. These objects are created by the make-draw-* functions and the positioning functions (position-and-fit-object, position-object, fit-object). An objects-displayer can also have in its description pinboard-objects-displayers, which can also contain hierarchies of drawings.

drawing-object is either a "drawing-object-spec", which is an instance of a subclass of drawing-object, or a list of "drawing-object-specs". The value can be modified later by (setf objects-displayer-drawing-object). The drawing objects in the objects slot are displayed after any pinboard-objects in the layout-description of pane (if any) are displayed. If it is a list, they are displayed according to the order in the list. This is implemented via a display-callback, so you cannot use :display-callback in an objects-displayer.

Objects which are the result of the positioning functions are being positioned and scaled again when the objects-displayer is resized, before being displayed.

use-metafile specifies whether the drawing of the objects should be done via a metafile. When using a metafile, the objects are first drawn to an internal metafile, which is then drawn to the pane. The result is another scaling (between the
size of the metafile and the size of pane). Note that means that objects that are drawn in their "absolute" size (not inside a fitting object, or explicitly absolute) are resized at that stage. Drawing via a metafile makes resizing better and faster.

When use-metafile is true, natural-width and natural-height define the size of the metafile to create in pixels. For objects that are supposed to be drawn in their absolute size, that will affect how much they are actually resized. The default value of use-metafile is true. The default value of natural-width x natural-height is 800 x 600.

Objects in the drawing-object list or inside the hierarchy inside any of these objects may change, which may require redisplaying it. The function force-objects-redraw can be used to force redrawing all the objects.

Notes

The drawing via the metafile is applicable only to the drawing objects, not to the pinboard-objects in the layout-description of the pane.

See also

position-object
fit-object
position-and-fit-object
make-draw-line
make-draw-lines
make-draw-arc
make-draw-polygon
make-draw-ellipse
make-draw-circle
make-draw-rectangle
force-objects-redraw

"Lower level - drawing objects and objects displayers" on page 229
pinboard-objects-displayer

Summary  A pinboard-object which draws its drawing-object.

Package  lw-gt

Superclasses  pinboard-object

Subclasses  None.

Accessors  pinboard-objects-displayer-objects

Description  The class pinboard-objects-displayer draws its drawing-object.

Like other pinboard-objects, to be displayed a pinboard-objects-displayer needs to be added to the description of a pinboard-layout, using the standard CAPI interface of pinboard-layout, that is :description passed to cl:make-instance, (setf capi:layout-description), or manipulate-pinboard.

When displayed, a pinboard-objects-displayer draws its drawing-object. If it was created with use-metafile t (see make-pinboard-objects-displayer), it draws to a metafile of the size indicated by natural-width and natural-height, and then draws the metafile to the screen using its own geometry as the target rectangle. Otherwise it may draw to the screen or use a pixmap cache.

The drawing-object in the pinboard-objects-displayer can be changed by (setf pinboard-objects-displayer-drawing-object), which automatically forces it to be redisplayed. If any of the objects inside the hierarchy below the drawing-object changes, there is no forced redisplay. You need to use force-objects-redraw on the pinboard-objects-displayer (or the parent objects-displayer) to redisplay.

See also   make-pinboard-objects-displayer
### string-drawing-object

**Class**

<table>
<thead>
<tr>
<th>Summary</th>
<th>A <code>drawing-object</code> which draws its string.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td><code>lw-gt</code></td>
</tr>
<tr>
<td>Superclasses</td>
<td><code>drawing-object</code></td>
</tr>
<tr>
<td>Subclasses</td>
<td>None.</td>
</tr>
<tr>
<td>Accessors</td>
<td>None.</td>
</tr>
<tr>
<td>Description</td>
<td>The class <code>string-drawing-object</code> draws its string. Instances are created by <code>make-draw-string</code>. See <code>make-draw-string</code> for the details. <code>string-drawing-object</code> objects can be used repeatedly and concurrently in the same or different panes.</td>
</tr>
<tr>
<td>See also</td>
<td><code>make-draw-string</code></td>
</tr>
</tbody>
</table>
This chapter describes symbols available in the `color` package.

### `apropos-color-alias-names`  
**Function**

**Summary**
Returns color aliases containing a given string.

**Package**
color

**Signature**
apropos-color-alias-names  
substring => list

**Arguments**

<table>
<thead>
<tr>
<th>substring</th>
<th>A string.</th>
</tr>
</thead>
</table>

**Values**

<table>
<thead>
<tr>
<th>list</th>
<th>A list of symbols.</th>
</tr>
</thead>
</table>

**Description**
Returns a list of symbols whose symbol-names contain `substring` and which are defined as aliases in the color-database defining color aliases. By convention these are in the keyword package.
In this example, a color alias is defined for the color `indianred1`. `apropos-color-alias-names` only returns this alias, rather than both the alias and the original color, despite the similarity in the names.

```
COLOR 8 > (define-color-alias :myindianred1
   :indianred1)
  ($(`COLOR-ALIAS COLOR :INDIANRED1))
COLOR 9 > (apropos-color-names "INDIANRED1")
  (/:INDIANRED1 :MYINDIANRED1)
COLOR 10 > (apropos-color-alias-names "INDIANRED1")
  (/:MYINDIANRED1)
COLOR 11 >
```

See also

- `apropos-color-names`
- `apropos-color-spec-names`
- `get-all-color-names`

Chapter 15, “The Color System”

### `apropos-color-names`  
**Function**  

**Summary**

Returns colors and color aliases containing a given string.

**Package**

`color`

**Signature**

`apropos-color-names substring => list`

**Arguments**

`substring`  
A string.

**Values**

`list`  
A list of symbols.

**Description**

Returns a list of symbols whose symbol-names contain `substring` and which are present in the color-database defining color aliases. By convention these are in the keyword package.
Example

COLOR-4> (color:apropos-color-names "RED")
(:ORANGERED3 :ORANGERED1 :INDIANRED3 :INDIANRED1
 :PALEVIOLETRED :RED :INDIANRED :INDIANRED2
 :INDIANRED4 :ORANGERED :MEDIUMVIOLETRED
 :VIOLETRED :ORANGERED2 :ORANGERED4 :RED1 :RED2 :RED3
 :RED4 :PALEVIOLETRED1 :PALEVIOLETRED2 :PALEVIOLETRED3
 :PALEVIOLETRED4 :VIOLETRED3 :VIOLETRED1 :VIOLETRED2
 :VIOLETRED4)

See also
apropos-color-alias-names
apropos-color-spec-names
get-all-color-names
Chapter 15, “The Color System”

apropos-color-spec-names

Function

Summary
Returns colors containing a given string.

Package
color

Signature
apropos-color-spec-names substring => list

Arguments
substring
A string.

Values
list
A list of symbols.

Description
Returns a list of symbols whose symbol-names contain substring and which are defined as original entries in the color-database defining color aliases. By convention these are in the keyword package.

Example
COLOR 14> (define-color-alias :mygray100 :gray100)
(#S(COLOR-ALIAS COLOR :GRAY100))
COLOR 15> (apropos-color-names "GRAY100")
(:MYGRAY100 :GRAY100)
COLOR 16> (apropos-color-spec-names "GRAY100")
(:GRAY100)
COLOR Reference Entries

See also

<table>
<thead>
<tr>
<th>See also</th>
</tr>
</thead>
<tbody>
<tr>
<td>apropos-color-alias-names</td>
</tr>
<tr>
<td>apropos-color-names</td>
</tr>
<tr>
<td>get-all-color-names</td>
</tr>
<tr>
<td>Chapter 15, “The Color System”</td>
</tr>
</tbody>
</table>

**color-alpha**

*Function*

**Summary**

Returns the alpha component of a color specification.

**Package**

color

**Signature**

color-alpha color-spec &optional default => alpha

**Arguments**

color-spec A color specification.

default A number between 0 and 1.

**Values**

alpha The alpha component of color-spec.

**Description**

color-spec is a color specification in any model.

color-alpha returns the alpha component of color-spec. If color-spec does not have an alpha component, then default is returned.

The default value of default is 1.0.

**See also**

make-hsv
make-rgb
make-gray
color-blue  
color-green  
color-red  
color-hue  
color-saturation  
color-value  

*Functions*

Summary
Returns the associated component of a color specification.

Package
color

Signature

\[
\begin{align*}
\text{color-blue} & \quad \text{color-spec} \Rightarrow \text{color-component} \\
\text{color-green} & \quad \text{color-spec} \Rightarrow \text{color-component} \\
\text{color-red} & \quad \text{color-spec} \Rightarrow \text{color-component} \\
\text{color-hue} & \quad \text{color-spec} \Rightarrow \text{color-component} \\
\text{color-saturation} & \quad \text{color-spec} \Rightarrow \text{color-component} \\
\text{color-value} & \quad \text{color-spec} \Rightarrow \text{color-component}
\end{align*}
\]

Arguments
\text{color-spec} \quad \text{A color specification.}

Values
\text{color-component} \quad \text{A color component from the appropriate color model.}

Description
If color-spec is not from the appropriate color model (:rgb in the case of color-red, color-green and color-blue, and :hsv in the case of color-hue, color-saturation and color-value) then the component is calculated.

Example

COLOR 31 > (color:make-rgb 1.0s0 0.0s0 0.0s0)
#:rgb 1.0s0 0.0s0 0.0s0

COLOR 32 > (color-red *)
1.0s0

COLOR 33 > (color-green **)
0.0s0
COLOR 34 > (color-value ***)
1.0S0

COLOR 35 >

See also
make-hsv
make-rgb
make-gray
color-model
color-level

*color-database* Variable

Summary The current color-database.

Package color

Description This should contain definitions for all the colors used in the environment when you start it. Those colors are determinable from the file `config/colors.db`.

Example To replace the current color database with a new one, do the following:

(setf color:*color-database* (color:make-color-db))

See also delete-color-translation
read-color-db
load-color-database
“Loading the color database” on page 247

color-from-premultiplied Function

Summary Transforms a color to its un-premultiplied version.

Package color
Signature  color-from-premultiplied  color => result
Arguments  color  A color-spec.
Values  result  A color-spec.
Description  The function color-from-premultiplied transforms a color, which is assumed to be premultiplied, to its un-pre-multiplied version.
            color should be a color-spec (see “Color specs” on page 243).
            If color is RGB with alpha it is transformed to its RGB un-pre-
            multiplied version. Otherwise color is returned without a change.
Notes  You get premultiplied colors when using Image Access,
       either by un converting (using unconvert-color) the result
       of image-access-pixel, or by reading the values from the vector that is filled by image-access-pixels-from-bgra.
See also  color-to-premultiplied
image-access-pixel
image-access-pixels-to-bgra
image-access-pixels-from-bgra
“Image access” on page 224

color-to-premultiplied

Function
Summary  Transform a color to its premultiplied version.
Package  color
Signature  color-to-premultiplied  color => result
Arguments  color  A color-spec.
The function `color-to-premultiplied` transforms a color to its premultiplied version, which is needed when modifying images using Image Access.

A color must be a color-spec, such as the result of a call to `make-rgb` (see “Color specs” on page 243).

If `color` does not have an alpha component, it is returned without a change. If it does have alpha, it is transformed to RGB if needed, and premultiplied, returning a premultiplied RGB color.

You need to premultiply when setting pixels using Image Access in an image with alpha. The result is unconverted, so when using `image-access-pixel` it still needs to be converted (by `convert-color`).

See also `color-from-premultiplied` `image-access-pixel` `image-access-pixels-to-bgra` `image-access-pixels-from-bgra` “Image access” on page 224

### color-level

**Function**

**Summary**

Returns the gray level of a color specification.

**Package**

`color`

**Signature**

`color-level color-spec => gray-level`

**Arguments**

`color-spec` A color specification.

**Values**

`gray-level` Color component from the :gray model.
Description
Return the gray level of color-spec. If color-spec is not from the :GRAY model, the component is calculated.

Example
COLOR 2 > (color:make-gray 0.66667s0)
#:GRAY 0.66667s0
COLOR 3 > (color-level *)
0.66667s0
COLOR 4 >

See also
make-hsv
make-rgb
make-gray
color-model
color-blue
“Color models” on page 244

color-model

Function
Summary
Returns the color-model for a color-spec.

Package
color

Signature
color-model color-spec => color-model

Arguments
color-spec A color specification.

Values
color-model :gray, :rgb, or :hsv.

Example
COLOR 29 > (color:make-gray 0.66667s0)
#:GRAY 0.66667s0
COLOR 30 > (color-model *)
:GRAY
COLOR 31 >
See also make-hsv
make-rgb
make-gray
color-blue
color-level
“Color specs” on page 243

color-with-alpha

Function

Summary
Adds a specified alpha component to a color.

Package
graphics-ports

Signature
color-with-alpha color alpha => color-spec

Arguments
color A color specification.
alpha A real in the inclusive range [0,1].

Values
color-spec A color specification, or nil.

Description
The function color-with-alpha returns a color like the argument color but with alpha component alpha.

color needs to be a color specification, either a keyword naming a color (a member of the result of calling get-all-color-names), or a color-spec (for example the result of make-rgb).

alpha must be a real in the inclusive range [0,1], otherwise an error is signaled. alpha = 0 means color-spec is transparent, alpha = 1 means it is solid.

color-with-alpha returns a color-spec, or nil if color is not recognized.
See also

- `get-all-color-names`
- `make-rgb`

“Color specs” on page 243

colors=  

*Function*

**Summary**
Tests to see if two colors are equal.

**Package**
color

**Signature**
colors= color1 color2 &optional tolerance => bool

**Arguments**
- `color1`  
  A color specification.
- `color2`  
  A color specification.
- `tolerance`  
  A tolerance level within which `color1` and `color2` may vary. The default value is 0.001s0.

**Values**
bool  
t if the two colors are equal within the given tolerance, nil otherwise.

**Description**
Return t if the two colors are equal to the given tolerance.

See also

- `ensure-color`
- `ensure-rgb`
- `convert-color`

Chapter 15, “The Color System”

convert-color  

*Function*

**Summary**
Return the representation of a color specification on a given graphics port.

**Package**
color
Signature

\texttt{convert-color} \texttt{port} \texttt{color} \&\texttt{key} \texttt{errorp} \Rightarrow \texttt{color-rep}

Arguments

\texttt{port} \hspace{1cm} \text{A graphics port.}
\texttt{color} \hspace{1cm} \text{A color specification.}
\texttt{errorp} \hspace{1cm} \text{If \texttt{t}, check for errors. By default, this is \texttt{t}.}

Values

\texttt{color-rep} \hspace{1cm} \text{Representation of \texttt{color} on \texttt{port}.}

Description

Return the representation of \texttt{color} on the given graphics port \texttt{port}. In CLX, this is the “pixel” value, which corresponds to an index into the default colormap. It is more efficient to use the result of \texttt{convert-color} in place of its argument in drawing function calls, but the penalty is the risk of erroneous colors being displayed should the colormap or the colormap entry be changed.

See also

\texttt{colors=}
\texttt{ensure-color}
\texttt{ensure-rgb}
\texttt{unconvert-color}
“Image access” on page 224
Chapter 15, “The Color System”

\textbf{define-color-alias} \hspace{1cm} \textit{Function}

Summary

Lets you define an alias for a color specification or alias.

Package

\texttt{color}

Signature

\texttt{define-color-alias} \texttt{name} \texttt{color} \&\texttt{optional} \texttt{if-exists} \Rightarrow \texttt{alias}

Arguments

\texttt{name} \hspace{1cm} \text{The name of the new alias.}
\texttt{color} \hspace{1cm} \text{A color specification for the new alias.}
if-exists

This can be one of the following:

:replace — Replace any existing alias.
:error — Raise an error if alias is already defined.
:ignore — Ignore redefinition of an alias.

By default, it is :replace.

Values

alias

The color alias.

Description

Define name to be a color alias for color, which may be another color alias or a color-spec.

Example 1

COLOR 16 > (define-color-alias :mygray :darkslategray)
(#S(COLOR-ALIAS COLOR :DARKSLATEGREY))

COLOR 17 > (define-color-alias :mygray :darkslategray :error)

Error: :MYGRAY names an existing alias for #(:RGB 0.1843133S0 0.309803S0 0.309803S0)

1 (continue) Replace :MYGRAY with the alias :DARKSLATEGREY
2 Continue, without redefining alias :MYGRAY
3 Try a new name for the alias, instead of :MYGRAY
4 (abort) Return to level 0.
5 Return to top loop level 0.
6 Destroy process.

Type :c followed by a number to proceed or type :? for other options

COLOR 18 : 1 >

Example 2

COLOR 19 > (define-color-alias :lispworks-blue (make-rgb 0.70s0 0.90s0 0.99s0))
(#S(COLOR-ALIAS COLOR #:RGB 0.699999S0 0.9S0 0.99S0))

COLOR 20 >

See also

get-color-alias-translation
get-color-spec

Chapter 15, “The Color System”
### define-color-models

**Macro**

**Summary**
Defines all the color models.

**Package**
color

**Signature**
define-color-models model-descriptors=> color-models

**Arguments**
model-descriptors A list, each element being a model-descriptor.

**Values**
color-models The color models defined.

**Description**
A model descriptor has the syntax:

\( (\text{model-name} \ \text{component-descr}^*) \)

A component-descr is a list:

\( (\text{component-name} \ \text{lowest-value} \ \text{highest-value}) \)

The default color models are defined by the following form:

\[
\begin{align*}
\text{(define-color-models} & (:(\text{rgb} (\text{red} 0.0 1.0) \\
& \quad (\text{green} 0.0 1.0) \\
& \quad (\text{blue} 0.0 1.0)) \\
& (:(\text{hsv} (\text{hue} 0.0 5.99999) \\
& \quad (\text{saturation} 0.0 1.0) \\
& \quad (\text{value} 0.0 1.0)) \\
& (:(\text{gray} (\text{level} 0.0 1.0))))
\end{align*}
\]

If you want to keep existing color models, add your new ones to this list: only one `define-color-models` form is recognized. The form should be compiled.

**Example**
To replace the HSV color model with a CMYK model, while retaining the other color models:
(define-color-models ((:rgb (red 0.0 1.0) (green 0.0 1.0) (blue 0.0 1.0)) (:cmyk (cyan 0.0 1.0) (magenta 0.0 1.0) (yellow 0.0 1.0) (black 0.0 1.0)) (:gray (level 0.0 1.0))))

See also Chapter 15, “The Color System”

delete-color-translation Function

Summary Removes an entry from the color-database.

Package color

Signature delete-color-translation color-name => <no values>

Arguments color-name A defined color spec or alias.

Values None.

Description Both original entries and aliases can be removed.

See also load-color-database
*color-database*
read-color-db
Chapter 15, “The Color System”

ensure-color Function

Summary Return a color specification in the model of a supplied color spec.

Package color
Signature  
**ensure-color**  *color-spec*  *match-color-spec*  =>  *result*

Arguments  
- **color-spec**  A color specification.
- **match-color-spec**  A color specification.

Values  
- **result**  A color specification.

Description  
The function **ensure-color** returns a color specification for  
*color-spec*, in the color model of *match-color-spec*. This allows  
you to convert color specifications from one model to another  
with having to explicitly state the color model.  

If *color-spec* has an alpha component, then *result* has that same  
alpha component.

Example  
(ensure-color (make-rgb 1 1 0 0.75) (make-hsv 0 0 0))
=>  
#(:HSV 1 1 1 0.75)

See also  
- convert-color
- colors=
- ensure-model-color

Chapter 15, “The Color System”

---

**ensure-model-color**  

Function

Summary  
Converts a color specification to a given model.

Package  
color

Signature  
**ensure-model-color**  *color-spec*  *model*  =>  *result*

Arguments  
- **color-spec**  A color specification.
- **model**  A color-model (:rgb, :hsv or :gray).

Values  
- **result**  A color specification.
Description

The function `ensure-model-color` returns a color specification for `color-spec` in the color model specified by `model`.

If `color-spec` has an alpha component, then `result` has that same alpha component.

Example

```lisp
(ensure-model-color (make-rgb 1 1 0 0.75) :hsv)
=>
#:HSV 1 1 1 0.75
```

See also

`convert-color`

`colors=`

`ensure-color`

`ensure-rgb`

Chapter 15, “The Color System”

---

**functions**

**ensure-rgb**

**ensure-hsv**

**ensure-gray**

Summary

Returns a color specification for a particular model.

Package

`color`

Signature

`ensure-rgb color-spec => result`

`ensure-hsv color-spec => result`

`ensure-gray color-spec => result`

Arguments

`color-spec` A color specification.

Values

`result` A color specification.

Description

The functions `ensure-rgb`, `ensure-hsv` and `ensure-gray` each return a color specification matching the supplied `color-spec`, but in the appropriate model.
If `color-spec` is in the same model, it is just returned. Otherwise a new color specification for that model is calculated. Thus, `ensure-rgb` returns a color specification in the RGB color model, whatever color model is used in `color-spec`.

If `color-spec` has an alpha component, then `result` has that same alpha component.

Example

```lisp
(ensure-hsv (make-rgb 1 1 0 0.75))
=> #(:HSV 1 1 1 0.75)

(ensure-gray (make-rgb 0 0 1 0.75))
=> #(:GRAY 0.33333302S0 0.75)
```

See also

- `convert-color`
- `colors= ensure-color`
- `ensure-model-color`
- “Color models” on page 244

### get-all-color-names

**Function**

**Summary**

Returns a list of all color-names in the color database.

**Package**

`color`

**Signature**

`get-all-color-names &optional sort => color-names`

**Arguments**

sort

If `t`, sort list of color names alphanumerically. By default, this is `nil`.

**Values**

color-names

A list of all color names in the color database.
Description
Returns a list of all color-names in the color database. By convention these are symbols in the keyword package. The returned list is alphanumerically sorted on the symbol-names if the optional argument is non-nil.

See also
apropos-color-names
apropos-color-spec-names
apropos-color-alias-names
Chapter 15, “The Color System”

get-color-alias-translation

Function

Summary
Return the ultimate color name associated with color-alias.

Package
color

Signature
get-color-alias-translation color-alias => color-name

Arguments
color-alias
A defined color alias.

Values
color-name
The color name associated with color-alias.

Example
COLOR 23 > (color:define-color-alias :lispworks-blue
       (color:make-rgb 0.70s0 0.90s0 0.99s0))
       (#S(COLOR-ALIAS COLOR #:RGB 0.699999S0 0.9S0 0.99S0))

COLOR 24 > (color:define-color-alias
       :color-background :lispworks-blue)
       (#S(COLOR-ALIAS COLOR :LISPWORKS-BLUE))

COLOR 25 > (color:define-color-alias
       :listener-background :color-background)
       (#S(COLOR-ALIAS COLOR :COLOR-BACKGROUND))

COLOR 26 > (get-color-alias-translation
       :listener-background)
       :LISPWORKS-BLUE

COLOR 27 > (color:get-color-alias-translation
       :color-background)
       :LISPWORKS-BLUE
See also

define-color-alias
get-color-spec

Chapter 15, “The Color System”

get-color-spec

Function

Summary
Returns the color-spec for a color.

Package
color

Signature
get-color-spec color => color-spec

Arguments
color A defined color specification, color alias, or an original color name.

Values
color-spec A color specification.

Description
Returns the color-spec for color, which can be a color-spec, a color-alias, or an original color name.

Example
COLOR 28 > (color:define-color-alias :lispworks-blue (color:make-rgb 0.70s0 0.90s0 0.99s0)) (#S(COLOR-ALIAS COLOR #(:RGB 0.699999S0 0.9S0 0.99S0)))
COLOR 29 > (color:define-color-alias :color-background :lispworks-blue) (#S(COLOR-ALIAS COLOR :LISPWORKS-BLUE))
COLOR 30 > (color:define-color-alias :listener-background :color-background) (#S(COLOR-ALIAS COLOR :COLOR-BACKGROUND))
COLOR 31 > (get-color-spec :listener-background) #(:RGB 0.699999S0 0.9S0 0.99S0)
COLOR 32 > (get-color-spec :color-background) #(:RGB 0.699999S0 0.9S0 0.99S0)
COLOR 33 > (get-color-spec :lispworks-blue)
#:(:RGB 0.699999S0 0.98S0 0.9980)
COLOR 34 > (get-color-spec
  #:(:RGB 0.70s0 0.90s0 0.99s0))
#:(:RGB 0.699999S0 0.98S0 0.9980)
COLOR 35 >

See also
define-color-alias
get-color-alias-translation
Chapter 15, "The Color System"

load-color-database

Function

Summary
Loads a color database.

Package
color

Signature
load-color-database data => <no values>

Arguments
data A description of a color database.

Values None.

Description
This loads the color database with color definitions contained in data, which should have been obtained via the functions color:read-color-db. The colors thus defined may not be replaced by color aliases.

See also
*color-database*
delete-color-translation
read-color-db
Chapter 15, "The Color System"
**make-gray**

**Function**

**Summary**
Returns a color specification in the gray model.

**Package**
color

**Signature**
make-gray level &optional alpha => color-spec

**Arguments**
- **level**: A color component used to define the gray level required.
- **alpha**: A number between 0 and 1, or nil.

**Values**
color-spec A color specification.

**Description**
Return a color-spec in the :GRAY model with component level. Note that short-floats are used for the component; this results in the most efficient color conversion process. However, any floating point number type can be used.

*alpha* indicates the alpha value of the color. 0 means it is transparent, 1 means it is solid. If *alpha* is nil or not specified then the color does not have an alpha component and it is assumed to be solid.

**Example**
COLOR 25 > (color:make-gray 0.66667s0)
#(:,GRAY 0.6666780)

**See also**
makes-hsv
make-rgb
color-model
color-blue
color-level
color-alpha
“Color specs” on page 243
**make-hsv**

*Function*

**Summary**

Returns a color specification in the hue-saturation-value model.

**Package**

color

**Signature**

`make-hsv hue saturation value &optional alpha => color-spec`

**Arguments**

- `hue` A hue component.
- `saturation` A saturation component.
- `value` A value component.
- `alpha` A number between 0 and 1, or `nil`.

**Values**

- `color-spec` A color specification.

**Description**

Return a color-spec in the :HSV model with components `hue`, `saturation` and `value`.

Note that short-floats are used for each component; this results in the most efficient color conversion process. However, any floating-point number type can be used.

`alpha` indicates the alpha value of the color. 0 means it is transparent, 1 means it is solid. If `alpha` is `nil` or not specified then the color does not have an alpha component and it is assumed to be solid.

**Example**

```
COLOR 27 > (color:make-hsv 1.2s0 0.5s0 0.9s0)
#(:HSV 1.2S0 0.5S0 0.9S0)
```

**See also**

- `make-rgb`
- `make-gray`
- `color-model`
- `color-blue`
- `color-level`
- `color-alpha`
- “Color specs” on page 243
**make-rgb**

*Function*

| Summary | Returns a color specification in the red-green-blue model. |
| Package | color |
| Signature | **make-rgb** red green blue &optional alpha => color-spec |
| Arguments | red: A red component. | green: A green component. | blue: A blue component. | alpha: A number between 0 and 1, or nil. |
| Values | color-spec: A color specification. |
| Description | Return a color-spec in the :RGB model with components red, green and blue. Note that short floats are used for each component; this results in the most efficient color conversion process. However, any floating point number type can be used. alpha indicates the alpha value of the color. 0 means it is transparent, 1 means it is solid. If alpha is nil or not specified then the color does not have an alpha component and it is assumed to be solid. |
| Example | The object returned by the following call defines the color red in the RGB model: |
| | COLOR 25 > (color:make-rgb 1.0s0 0.0s0 0.0s0) |
| | # (:RGB 1.0S0 0.0S0 0.0S0) |
| See also | make-hsv |
| | make-gray |
| | color-model |
| | color-blue |
**read-color-db**

**Function**

**Summary**
Reads the color definitions contained in a file.

**Package**
color

**Signature**
read-color-db &optional file => color-database

**Arguments**
file
A filename or pathname containing the color definitions to be read. If file is not given, read-color-db uses the default color definitions file in the LispWorks library.

**Values**
color-database
A database definition.

**Description**
This reads color definitions from the given file (a filename or pathname). The returned data structure can be passed to color:load-color-database. The format of the file is:

```
#:RGB 1.0s0 0.980391s0 0.980391s0)     snow
#:RGB 0.972548s0 0.972548s0 1.0s0)     GhostWhite
...
```

Each line contains a color definition which consists of a color-spec and a name. The names are converted to uppercase and interned in the keyword package. Whitespace in names is preserved.

**See also**
load-color-database
*color-database*
delete-color-translation
Chapter 15, “The Color System”
unconvert-color  

Function

Summary  
Returns a color specification for a color representation.

Package  
color

Signature  
unconvert-color  
port  
color-rep  
=>  
color

Arguments  
port  
A graphics port.

color-rep  
A color representation on port.

Values  
color  
A color specification.

Description  
The function unconvert-color returns a color specification  
corresponding to the color representation color-rep on the  
Graphics Port port.

If color-rep is a color specification, a symbol or a color alias,  
then it is simply returned since the color system can interpret  
these directly.

Otherwise color-rep is assumed to be a color representation on  
port, like those returned by convert-color and image-  
access-pixel, and a corresponding RGB value is returned.

See also  
convert-color
image-access-pixel
“Image access” on page 224
Index

Numerics

2π constant 1025

A

abort-callback function 289
abort-dialog function 167, 290
abort-exit-confirm function 291
:accelerator initarg 119, 638
Accelerators 119, 555, 638
accepts-focus-p generic function 292
:accepts-focus-p initarg 14, 357, 465
accessor functions
  application-interface-application-menu 349
  application-interface-dock-menu 349
  application-interface-message-callback 349
  browser-pane-before-navigate-callback 305
  browser-pane-debug 305
  browser-pane-document-complete-callback 305
  browser-pane-internet-explorer-callback 305
  browser-pane-navigate-complete-callback 305
  browser-pane-navigate-error-callback 305
  browser-pane-new-window-callback 305
  browser-pane-status-text-change-callback 305
  browser-pane-successful-p 305
  browser-pane-title 305
  browser-pane-title-change-callback 305
  browser-pane-update-commands-callback 305
  browser-pane-url 305
  button-alternate-callback 796
  button-armed-image 317
  button-cancel-p 317
  button-default-p 317
  button-disabled-image 317
  button-enabled 317
  button-image 317
  button-press-callback 796
  button-selected 317
  button-selected-disabled-image 317
  button-selected-image 317
  callbacks-action-callback 330
  callbacks-callback-type 330
  callbacks-extend-callback 330
  callbacks-retract-callback 330
  callbacks-selection-callback 330
  capi-object-name 265, 333
interface-pathname 532
interface-pointer-documentation-enabled 532
interface-title 18, 150, 532
interface-toolbar-items 532
interface-toolbar-states 532
interface-tooltip-enabled 532
interface-window-styles 532
item-collection 568
item-data 568
item-print-function 568
item-selected 568
item-text 568
labelled-line-text-background 572
labelled-line-text-foreground 572
layout-description 96, 574
layout-ratios 365, 828
layout-x-adjust 1024
layout-x-gap 512
layout-x-ratios 512
layout-y-adjust 1024
layout-y-gap 512
layout-y-ratios 512
list-panel-image-function 579
list-panel-keyboard-search-callback 579
list-panel-right-click-selection-behavior 579
list-panel-state-image-function 579
list-view-auto-arrange-icons 596
list-view-auto-reset-column-widths 596
list-view-columns 596
list-view-image-function 596
list-view-state-image-function 596
list-view-subitem-function 596
list-view-subitem-print-functions 596
list-view-view 596
menu-image-function 631
menu-items 631
menu-object-enabled 645
menu-popup-callback 645
menu-title 645
menu-title-function 645
ole-control-component-pane 666
option-pane-enabled 678
option-pane-enabled-positions 678
option-pane-image-function 678
option-pane-popup-callback 678
option-pane-separator-item 678
option-pane-visible-items-count 678
output-pane-composition-callback 684
output-pane-create-call-back 684
output-pane-destroy-call-back 684
output-pane-display-call-back 684
output-pane-focus-callback 684
output-pane-graphics-options 684
output-pane-input-model 684
output-pane-resize-call-back 684
output-pane-scroll-call-back 684
pane-layout 95, 322, 532
password-pane-overwrite-character 720
pinboard-object-activepinboard 728
pinboard-object-graphics-args 728
pinboard-object-pinboard 728
popup-menu-button-menu 749
popup-menu-button-menu-function 749
range-callback 804
range-end 804
range-orientation 804
range-slug-end 804
range-slug-start 804
range-start 804
rich-text-pane-change-callback 819
rich-text-pane-limit 819
rich-text-pane-text 819
function 981
tree-view-checkbox-initial-status 981
tree-view-checkbox-next-map 981
tree-view-checkbox-parent-function 981
tree-view-checkbox-status 981
tree-view-children-function 981
tree-view-expandp-function 981
tree-view-has-root-line 981
tree-view-image-function 981
tree-view-leaf-node-p-function 981
tree-view-retain-expanded-nodes 981
tree-view-right-click-extended-match 981
tree-view-roots 981
tree-view-state-image-function 981
accessors
  basic-graph-spec-color 1179
  basic-graph-spec-function 1179
  basic-graph-spec-name 1179
  basic-graph-spec-range 1179
  basic-graph-spec-start-x 1179
  basic-graph-spec-step-x 1179
  basic-graph-spec-thickness 1179
  basic-graph-spec-var1 1179
  basic-graph-spec-var2 1179
  basic-graph-spec-var3 1179
  basic-graph-spec-var4 1179
  basic-graph-spec-var5 1179
  basic-graph-spec-var6 1179
  basic-graph-spec-x-offset 1179
  basic-graph-spec-x-scale 1179
  basic-graph-spec-y-offset 1179
  basic-graph-spec-y-scale 1179
choice-selection 54
collection-items 66
compound-drawing-object-data 1180
compound-drawing-object-sub-object 1180
display-pane-text 21
editor-pane-line-wrap-face 26
editor-pane-line-wrap-marker 26
editor-pane-text 26
graph-edge-from 60
graph-edge-to 60
graph-node-height 60
graph-node-in-edges 59
graph-node-out-edges 59
graph-node-width 60
graph-node-x 60
graph-node-y 60
graph-pane-direction 59
graph-pane-layout-function 59
graph-pane-roots 56
item-data 32
item-print-function 32
item-text 32
objects-displayer-objects 1211
output-pane-input-model 186, 685
pinboard-objects-displayer-objects 1213
simple-pane-cursor 15
:action-callback initarg 53, 58, 63, 329
:action-callback-expand-p initarg 979
:activate-callback initarg 529
activate-pane function 293
:activep initarg 727, 804
active-pane-copy function 294
active-pane-copy-p function 294
active-pane-cut function 294
active-pane-cut-p function 294
active-pane-deselect-all function 294
active-pane-deselect-all-p function 294
active-pane-paste function 294
active-pane-paste-p function 294
active-pane-select-all function 294
active-pane-select-all-p function 294
active-pane-undo function 294
active-pane-undo-p function 294
ActiveX 672
:adjust initarg 365, 828
:adjust item in :buttons initarg 935
:after-input-callback initarg 25, 283, 448
"alive" interface
definition 475
"alive" pane
definition 298
:alternate-callback initarg 796
:alternating-background initarg 53, 55, 577
:alternative initarg 120, 638
:alternative-action-callback initarg 63, 330
analyze-external-image function 1026
anti-aliasing 452, 503, 684, 899, 1010, 1020, 1096, 1100
text on GTK+ 723
text on Microsoft Windows 723
append-items generic function 295
Application menu 29, 349
for LispWorks applications 124
application-interface-application-menu accessor function 349
application-interface-dock-menu accessor function 349
application-interface-message-callback accessor function 349
:application-menu initarg 349
apply-drawing-object class 1178
apply-in-pane-process function 39, 97, 296
apply-in-pane-process-if-alive function 39, 97, 297
apply-rotation function 1026
apply-rotation-around-point function 1027
apply-scale function 1028
apply-translation function 1029
apropos-color-alias-names function 243, 1215
apropos-color-names function 242, 1216
apropos-color-spec-names function 243, 1217
:armed-image initarg 316
:armed-images initarg 321
arrow-pinboard-object class 298
attach-interface-for-call-back function 300
attach-simple-sink function 301
attach-sink function 302
augment-font-description function 218, 1030
:auto-arrange-icons initarg 595
:automatic-resize initarg 190, 727, 884
:auto-menus initarg 122, 529
:auto-reset-column-widths initarg 595, 654

B
background graphics state parameter 1093
:background initarg 12, 883
balloon help 35
basic-graph-spec structure class 1179
basic-graph-spec-color accessor 1179
basic-graph-spec-function accessor 1179
basic-graph-spec-name accessor 1179
basic-graph-spec-p function 1205
basic-graph-spec-range accessor 1179
basic-graph-spec-start-x accessor 1179
basic-graph-spec-step-x accessor 1179
basic-graph-spec-thickness accessor 1179
basic-graph-spec-var1 accessor 1179
basic-graph-spec-var2 accessor 1179
basic-graph-spec-var3 accessor 1179
basic-graph-spec-var4 accessor 1179
basic-graph-spec-var5 accessor 1179
basic-graph-spec-var6 accessor 1179
basic-graph-spec-x-offset accessor 1179
basic-graph-spec-x-scale accessor 1179
sor 1179

**basic-graph-spec-y-offset** accessor 1179
**basic-graph-spec-y-scale** accessor 1179

**beep-pane** function 303

**:before-input-callback** initarg 25, 283, 448

**:before-navigate-callback** initarg 304

**:best-height** initarg 176, 177, 529

**:best-width** initarg 176, 529

**:best-x** initarg 529

**:best-y** initarg 529

Bézier curve 1053

**bezier curve** 1053

**boole** function 215

**break gesture**
on Cocoa 268
   on GTK+ 268
   on Microsoft Windows 267
   on Motif 271

**:browse-file** item in **:buttons** initarg 934

**browser-pane** class 28, 304

**browser-pane-available-p** function 312

**browser-pane-before-navigate-callback** accessor function 305

**browser-pane-busy** function 313

**browser-pane-debug** accessor function 305

**browser-pane-document-complete-callback** accessor function 305

**browser-pane-go-back** function 313

**browser-pane-go-forward** function 313

**browser-pane-internet-explorer-callback** accessor function 305

**browser-pane-navigate** function 313

**browser-pane-navigate-complete-callback** accessor function 305

**browser-pane-navigate-error-callback** accessor function 305

**browser-pane-new-window-callback** accessor function 305

**browser-pane-property-get**
generic function 315

**browser-pane-property-put**
generic function 315

**browser-pane-refresh** function 313

**browser-pane-status-text-change-callback** accessor function 305

**browser-pane-stop** function 313

**browser-pane-successful-p** accessor function 305

**browser-pane-title** accessor function 305

**browser-pane-update-commands-callback** accessor function 305

**browser-pane-url** accessor function 305

**bubble help** 35

**:buffer** initarg 448

**:buffer-modes** initarg 448

**:buffer-name** initarg 27, 363, 448

built-in scrolling 496

**button** class 315

button panels
   orientation 45
   prompting with 158–159

**button-alternate-callback**
   accessor function 796

**button-armed-image** accessor function 317

**button-cancel-p** accessor function 317

**:button-class** initarg 321

**button-default-p** accessor function 317

**button-disabled-image** accessor function 317

**button-enabled** accessor function 317

**:button-height** initarg 960

**button-image** accessor function 317

**button-panel** class 44, 321

**button-press-callback** accessor function 796

buttons
   check 33
   push 32
   radio 33

**:buttons** initarg 22, 926

**button-selected** accessor function 317
button-selected-disabled-image accessor function 317
button-selected-image accessor function 317
:button-width initarg 960

C

calculate-constraints generic function 71, 81, 326
calculate-layout generic function 71, 327
:callback initarg 21, 32, 316, 318, 480, 644, 804, 840, 925, 951, 963
:callback-data-function initarg 644
:callback-object initarg 479
callbacks description of 8
for button panels 321
for buttons 318
general properties 19
graph panels 58
in choices 63
in interfaces 147–149
passing different variables 301
used for choices 50–53
using callback functions 11
callbacks class 19, 44, 329
:callbacks initarg 321, 960, 969
callbacks-action-callback accessor function 330
callbacks-callback-type accessor function 330
callbacks-extend-callback accessor function 330
callbacks-retract-callback accessor function 330
callbacks-selection-callback accessor function 330
:callback-type initarg 19, 63, 329, 919, 925, 951
call-editor function 147
call-editor generic function 25, 169, 328
:cancel item in :buttons initarg 933
cancel-button image identifier 936
:cancel-button initarg 321
:cancel-function item in :buttons initarg 934
:cancel-p initarg 316
can-use-metafile-p function 332

CAPI

basic objects 2–3
description of 1–3
linking code into 8
using the 5–6
CAPI process 402
capi-object class 333
capi-object-name accessor function 265, 333
capi-object-plist accessor function 265, 333
capi-object-property function 334
caret-position initarg 925
:change-callback initarg 24, 448, 479, 819, 925, 951
:change-callback-type initarg 925
:character-format initarg 818
charts and graphs self-contained examples 286
check button panels 46
check buttons 33
:checkbox-change-callback initarg 980
:checkbox-child-function initarg 980
:checkbox-initial-status initarg 980
:checkbox-next-map initarg 980
:checkbox-parent-function initarg 980
:checkbox-status initarg 980
check-button class 33, 44, 335
check-button-panel class 44, 46, 62, 336
%child geometry slot 1013
:child initarg 898
children
of a layout 69
:children-function initarg 57, 501, 979
choice class 43, 337
:choice-class initarg 158
choice-initial-focus-item accessor function 338
choice-interaction accessor function 62, 338
choices 43–67
callbacks available 63
description of 43–67
general properties 62–67
relationship to menus 61
choice-selected-item accessor
function 63
choice-selected-item generic function 341
choice-selected-item-p function 342
choice-selected-items accessor function 63
choice-selected-items generic function 343
choice-selection accessor 54
choice-selection accessor function 63, 338
choice-update-item function 345
classes
apply-drawing-object 1178
arrow-pinboard-object 298
browser-pane 28, 304
button 315
button-panel 44, 321
callbacks 19, 44, 329
capi-object 333
check-button 33, 44, 335
check-button-panel 44, 46, 62, 336
choice 43, 337
cocoa-default-application-interface 29, 349
cocoa-view-pane 29, 353
collection 43, 357
collections 44
collector-pane 363
color-screen 364
column-layout 45, 72, 74, 142, 365
compound-drawing-object 1180
creating your own 173–198
define-ole-control-component 29
display-pane 21, 75, 412
docking-layout 418
document-container 424
document-frame 92, 424
double-headed-arrow-pinboard-object 425
double-list-panel 426
drawing-object 1183
drawn-pinboard-object 194, 211, 437
echo-area-pane 445
editor-pane 23, 75, 147, 168, 172, 206, 448
element 464
ellipse 471
expandable-item-pinboard-object 478
extended-selection-tree-view 55, 478
external-image 219, 1066
filtering-layout 479
foreign-owned-interface 488
form-layout 489
geometry-drawing-object 1201
graph-edge 498
graphics-port-mixin 1091
graph-node 499
graph-object 500
graph-pane 56, 206, 500
grid-layout 14, 76, 511
image 219, 1101
image-list 53, 55, 518
image-pinboard-object 520
image-set 521
interactive-pane 30, 525
interface 2, 18, 35, 70, 138, 528
item 567
item-pinboard-object 190, 570
labelled-arrow-pinboard-object 571
labelled-line-pinboard-object 572
layout 573
line-pinboard-object 575
listener-pane 31, 75, 600
list-panel 14, 48, 170, 577
list-view 594
menu 2, 110, 121, 631
menu-component 2, 111, 636
menu-item 2, 114, 121, 638
menu-object 644
message-pane 650
metafile-port 650
mono-screen 653
multi-column-list-panel 654
multi-line-text-input-pane 22, 659
non-focus-list-interface 661
objects-displayer 1210
ole-control-component 29, 666
ole-control-doc 668
ole-control-frame 669
ole-control-pane 29, 672
ole-control-pane-simple-sink 675
option-pane 14, 60, 677
output-pane 26, 35, 80, 122, 173, 199, 205, 206, 242, 249, 682
password-pane 720
pinboard-layout 35, 77, 187, 191, 206, 721
pinboard-object 69, 187, 726
pinboard-objects-displayer 1213
pixmap-port 1131
popup-menu-button 749
printer-port 251, 760
progress-bar 29, 764
push-button 32, 44, 796
push-button-panel 44, 798
radio-button 34, 801
radio-button-panel 44, 45, 62, 802
range-pane 29, 804
rectangle 807
rich-text-pane 27, 818
right-angle-line-pinboard-object 827
row-layout 45, 72, 828
screen 830
scroll-bar 29, 840
shell-pane 879
simple-layout 882
simple-network-pane 882
simple-pane 69, 883
simple-pinboard-layout 897
slider 29, 900
sorted-object 903
static-layout 909
string-drawing-object 1214
switchable-layout 915
tab-layout 88, 918
text-input-choice 923
text-input-pane 14, 21, 70, 168, 172, 925
text-input-range 950
titled-menu-object 954
titled-object 14, 17, 954
titled-pinboard-object 958
title-pane 17, 242, 952
toolbar 125, 134, 960
toolbar-button 35, 963
toolbar-component 36, 127, 968
toolbar-object 971
tracking-pinboard-layout 978
tree-view 55, 978
x-y-adjustable-layout 1023
clear-external-image-conversions function 222, 1031
clear-graphics-port function 1031
clear-graphics-port-state function 1032
clear-rectangle function 1032
clip 211, 213, 1095, 1162
clipboard function 346
clipboard-empty function 348
clipping 211, 213, 1095, 1162
close menu command 411
:close-callback initarg 672
CLUE 3
cues 35
CLX 3
Cocoa Event Loop process 403
Cocoa view class 29
cocoa-default-application cocoa-default-application-interface class 29
cocoa-default-application-interface class 349
cocoa-view-pane class 29, 353
cocoa-view-pane-init-function accessor function 353
cocoa-view-pane-view function 29, 355
cocoa-view-pane-view-class accessor function 353
collect-interfaces generic function 355
collection class 43, 357
:collection initarg 567
collection-find-next-string generic function 360
collection-find-string generic function 361
collection-items accessor 66
collection-items accessor function 102, 358
collection-items-count-function accessor function 358
collection-items-get-function accessor function 358
convert-relative-position function 373
convert-to-font-description function 1035
convert-to-screen function 269, 271, 374

copy defining operation for your interface class 105
operation on active element 104
copy-area function 206, 1036
copy-basic-graph-spec function 1205
copy-external-image function 1038
copy-pixels function 1038
copy-transform function 1040
count-collection-items

generic function 377
:create-callback initarg 98, 529, 666, 683
create-dummy-graphics-port function 378
create-pixmap-port function 206, 210, 1040
creating menus 109
creating submenus 110
creating toolbars 125
current-dialog-handle function 379
current-document generic function 380
current-pointer-position function 380
current-popup function 381
current-printer function 249, 382
current-process-send function 40
cursor format

| on Cocoa 601 |
| on GTK+ 601 |
| on Microsoft Windows 601 |
cursor initarg 15, 884
cut defining operation for your interface class 105
operation on active element 104

dash graphics state parameter 1095
dashed graphics state parameter 1095

data callback type 64
data initarg 8, 32, 567
data-function initarg 281
data-interface callback type 64
debug initarg 305
default initarg 573
default settings
selections 53
default-button initarg 321
*default-editor-pane-line-wrap-marker* variable 383
*default-image-set initarg 961, 969
*default-image-translation-table* variable 1042, 1110
:definites initarg classes 140, 142
default-library function 384
*default-non-focus-message-timeout* variable 383
*default-non-focus-message-timeout-extension* variable 383
:definites initarg pinitarg 316
:default-toolbar-states initarg 531
defclass macro 138, 140, 176
define-color-alias function 246, 1226
define-color-models macro 247, 1228
define-command macro 384
define-font-alias function 1042
define-interface macro 138, 387
arguments supplied to 140
define-layout macro 394
define-menu macro 395
define-ole-control-component

class 29
define-ole-control-component

macro 396
definition class option 388
defpackage function 6
delete-color-translation function 246, 247, 1229
delete-item-callback initarg 979
deliver function 106, 221
depth initarg 830
description initarg 69, 73, 187, 564, 573, 918, 920
description of the CAPI 1–3
destroy button
removal 538
destroy generic function 106, 398
:destroy-callback initarg 529, 666, 683
destroy-dependent-object
generic function 399
destroy-pixmap-port function 1043
detach-simple-sink function 400
detach-sink function 401
dialog continuation function
creating 1005
using 405, 701, 742, 754, 767, 769, 772, 774, 776, 777, 778, 782, 784, 785, 787, 795
dialogs
aborting 290
creating your own 163–167
description of 153–167
in front 162
modal 161
owners 162–163
:directories-only initarg 926
:disabled-image initarg 316
:disabled-images initarg 321
display callback 176
display function 7, 8, 39, 271, 402
display panes 20
:display-callback initarg 224, 437, 682, 1211
display-dialog function 163, 167, 404
display-errors macro 407
displaying text on screen 20
display-message function 9, 154, 407
display-message-for-pane function 408
display-message-on-screen function 408
display-non-focus-message function 409
display-pane class 21, 75, 412
display-pane-selected-text function 413
display-pane-selection function 414
display-pane-selection-p function 414
display-pane-text accessor 21
display-pane-text accessor function 412
display-popup-menu function 123, 415
display-replacable-dialog function 416
:display-state initarg 530
display-tooltip generic function 417
dither-color-spec function 1043
:divider-p initarg 419
:dividerp initarg 960
dividers 90
Dock menu 29, 349
:docking-callback initarg 419
docking-layout class 418
docking-layout-controller accessor function 419
docking-layout-divider-p accessor function 419
docking-layout-docking-test-function accessor function 419
docking-layout-items accessor function 419
docking-layout-orientation accessor function 419
docking-layout-pane-docked-p function 422
docking-layout-pane-visible-p function 423
:docking-test-function initarg 419
:dock-menu initarg 349
document changed
on Cocoa 151, 550
document modified
on Cocoa 151, 550
document unsaved
on Cocoa 151, 550
:document-complete-callback initarg 304
document-container class 424
document-frame class 92, 424
document-frame-container accessor function 424
double buffering 206
double-headed-arrow-pin-board-object class 425
:double-head-predicate initarg 425
double-list-panel class 426
Drag and drop
coordinates 443
dragging 429
dropping 884, 885
effect 438, 441
formats 444, 855
in an output-pane 276
object 442
self-contained examples 279
temporary display 907, 908
visual feedback while dragging 276
:drag-callback initarg 884
:drag-image initarg 531
drag-pane-object function 429
draw-arc function 212, 1044
draw-arcs function 212, 1045
draw-character function 212, 1046
draw-circle function 175, 1047
draw-ellipse function 212, 1048
draw-image function 219, 220, 1049
drawing bar charts 236
drawing graphs 236
:draw-mode initarg 682
drawing-object class 1183
:editor-pane buffer accessor function 26, 457
draw-object-allows-drop-effect-p function 438
draw-object-collection-index function 439
draw-object-collection-item function 440
draw-object-drop-effect function 441
draw-object-get-object function 442
draw-object-pane-x generic function 443
draw-object-pane-y generic function 443
draw-object-provides-format function 444

E
:echo-area initarg 24, 448
*echo-area-cursor-inactive-style* variable 445
echo-area-pane class 445
:edge-pinboard-class initarg 501
Edit > Copy menu command 119
Edit > Cut menu command 119
Edit > Find... menu command 119
Edit > Paste menu command 119
Edit > Redo menu command 119
Edit > Replace... menu command 119
Edit > Select All menu command 119
Edit > Undo menu command 119
Edit menu 122
edit operations
  defining for your interface class 105
  on active element 104
:editing-callback initarg 926
  editor panes 23
*editor-cursor-active-style* variable 446
*editor-cursor-color* variable 446
*editor-cursor-drag-style* variable 447
*editor-cursor-inactive-style* variable 447
editor-pane class 23, 75, 147, 168, 172, 206, 448
subclasses 30
editor-pane-blink-rate generic function 26, 457
editor-pane-buffer accessor function 458
editor-pane-change-callback
accessor function 449

editor-pane-composition-face
accessor function 449

*editor-pane-composition-selected-range-face-plist* variable 459

editor-pane-default-composition-face
accessor function 449

*editor-pane-default-composition-selected-range-face-plist* variable 459

editor-pane-enabled
accessor function 449

editor-pane-fixed-fill
accessor function 449

editor-pane-line-wrap-face
accessor 26

editor-pane-line-wrap-face
accessor function 449

editor-pane-line-wrap-marker
accessor 26

editor-pane-line-wrap-marker
accessor function 449

editor-pane-native-blink-rate
function 26, 462

editor-pane-selected-text
function 26

david-pane-selected-text
generic function 462

david-pane-selected-text-p
function 26

david-pane-selected-text-p
generic function 462

david-pane-stream
generic function 463

david-pane-text
accessor 26

david-pane-text
accessor function 102, 148, 449

david-pane-wrap-style
accessor function 449

david-window
generic function 464
:element callback type 64

element-container function 470

element-interface
accessor function 466

element-interface-for-callback
generic function 470

element-parent
accessor function 27, 466

creating your own 173–198
generic properties of 11–12
david-screen
function 471
element-widget-name
accessor function 269, 466
element
class 471
:enabled initarg 27, 32, 316, 448, 479,
644, 677, 883, 925, 971
:enabled-function
initarg 120, 644, 971
:enabled-function-for-dialog
initarg 121, 639
:enabled-positions
initarg 677
:enabled-slot
initarg 644
:enable-pointer-documentation
initarg 530
:enable-tooltips
initarg 530
:end-x
initarg 188, 575
:end-y
initarg 188, 575
default-visible
generic function 472
default-color
function 245, 1229
default-gdiplus
function 1064
default-gray
function 1231
default-hsv
function 1231
default-interface-screen
function 472
default-model-color
function 245, 1230
default-rbg
function 1231

Escape key 740
:evaluate
keyword argument 161
event handler
key strokes
mouse click
mouse gestures
mouse move
event handlers
177–186
default-with-interface
function 39, 97, 473
default-with-interface-if-alive
function 39, 97, 474
deexit-confirm
function 163, 165, 476
default-dialog
function 165, 167, 477
default-item-pinboard-object
class 478
default-function
initarg 979
default-callback
initarg 52, 58, 63, 329
defaulting selection
specifying 62

elements
using on different platforms 62
:extended-selection interaction style 49, 50, 62
extended-selection-tree-view class 55, 478
extension gesture 50
external constraints 80
external image
dimensions 224
from displayed window 227
from on-screen window 227
width and height 224
:external-border initarg 530
external-image class 219, 1066
external-image-color-table function 1067
externalize-and-write-table function 221, 1068
externalize-image function 222, 1070
:external-max-height initarg 81, 466, 728
:external-max-width initarg 81, 466, 727
:external-min-height initarg 81, 465, 727
:external-min-width initarg 80, 465, 727

F
f2pi constant 1071
File > Close menu command 119
File > Exit menu command 119
File > New menu command 119
File > Open... menu command 119
File > Print... menu command 119
File > Save menu command 119
:filename initarg 819
files prompting for 159–161
filled accessor function 471, 808
:filled initarg 471, 808
fill-style graphics state parameter 1094
:filter initarg 53, 482, 577
:filter-automatic-initarg 578
:filter-callback initarg 578
:filter-change-callback-p initarg 578
:filter-help-callback-p initarg 578
filtering-layout class 479
filtering-layout-matches-
text accessor function 480
filtering-layout-match-
object-and-exclude-p function 484
filtering-layout-state accessor function 480
:filter-matches-title initarg 578
:filter-short-menu-text initarg 578
find-best-font function 217, 1072
find-graph-edge generic function 484
find-graph-node generic function 485
finding panes interfaces 388
find-interface generic function 486
find-matching-fonts function 217, 1073
find-pane 388
find-string-in-collection
generic function 487
fit-object function 1185
:fit-size-to-children initarg 910
:fixed-fill initarg 448
:flag initarg 448
:flatp initarg 961
focus for keyboard gestures 14
for keyboard input 14
keyboard input on Cocoa 539
mouse events on Cocoa 539
moving to a new pane 293
setting to a pane 707, 867
:focus-callback initarg 683
folding toolbars 125
font graphics state parameter 1096
:font initarg 12, 884
font type 1074
font-description function 1076
font-description type 1075
font-description-attributes function 1077
font-description-attribute-
value function 1076
font-dual-width-p function 1077
font-fixed-width-p function 1078
fonts 12
attributes 217
lookup 218
prompting for 160
font-single-width-p function 1079
force-objects-redraw function 1189
force-screen-update function 487
force-update-all-screens function 488
foreground graphics state parameter 1092
:foreground initarg 12, 884
foreign-owned-interface class 488
form-layout class 489
form-title-adjust accessor function 489
form-vertical-adjust accessor function 489
form-vertical-gap accessor function 489
form-vertical-gap accessor function 489
fpi constant 1079
fpi-by-2 constant 1079
frame 18, 956
free-image function 219, 223, 1080
free-image-access function 225, 1080
free-metafile function 490
free-sound function 491
:from initarg 498
full screen windows on Cocoa 539
functions
abort-callback 289
abort-dialog 167, 290
abort-exit-confirm 291
activate-pane 293
active-pane-copy 294
active-pane-copy-p 294
active-pane-cut 294
active-pane-cut-p 294
active-pane-deselect-all 294
active-pane-deselect-all-p 294
active-pane-paste 294
active-pane-paste-p 294
active-pane-select-all 294
active-pane-select-all-p 294
active-pane-undo 294
active-pane-undo-p 294
analyze-external-image 1026
apply-in-pane-process 39, 97, 296
apply-in-pane-process-if-alive 39, 97, 297
apply-rotation 1026
apply-rotation-around-point 1027
apply-scale 1028
apply-translation 1029
apropos-color-alias-names 243, 1215
apropos-color-names 242, 1216
apropos-color-spec-names 243, 1217
attach-interface-for-call-back 300
attach-simple-sink 301
attach-sink 302
augment-font-description 218, 1030
basic-graph-spec-p 1205
beep-pane 303
boole 215
browser-pane-available-p 312
browser-pane-busy 313
browser-pane-go-back 313
browser-pane-go-forward 313
browser-pane-navigate 313
browser-pane-refresh 313
browser-pane-stop 313
call-editor 147, 169
can-use-metafile-p 332
capi-object-property 334
choice-selected-item-p 342
choice-update-item 345
clear-external-image-versions 222, 1031
clear-graphics-port 1031
clear-graphics-port-state 1032
clear-rectangle 1032
clipboard 346
clipboard-empty 348
cocoa-view-pane-view 29, 355
color-blue 1219
color-from-premultiplied 1220
color-green 1219
color-hue 1219
color-level 1218, 1222
color-model 1223
color-red 1219
colors= 245, 1225
color-saturation 1219
color-spec-model 244
color-spec-p 244
color-to-premultiplied 1221
color-value 1219
color-with-alpha 1224
color-with-alpha 1224
complete-in-place 172
complete-in-place 172
compress-external-image 1033
compress-external-image 1033
compute-char-extents 1034
compute-char-extents 1034
compute-drawing-object-from-data 1181
compute-drawing-object-from-data 1181
confirm-pane 370
confirm-pane 370
confirm-yes-or-no 155, 370
confirm-yes-or-no 155, 370
contain 7, 39, 190, 371
contain 7, 39, 190, 371
convert-color 225, 245, 1225
convert-color 225, 245, 1225
convert-external-image 1035
convert-external-image 1035
copy-area 206, 1036
copy-area 206, 1036
copy-basic-graph-spec 1205
copy-basic-graph-spec 1205
copy-external-image 1038
copy-external-image 1038
copy-pixels 1038
copy-pixels 1038
copy-transform 1040
copy-transform 1040
create-dummy-graphics-port 378
create-dummy-graphics-port 378
create-pixmap-port 206, 210, 1040
current-dialog-handle 379
current-dialog-handle 379
current-pointer-position 380
current-pointer-position 380
current-popup 381
current-popup 381
current-printer 249, 382
current-printer 249, 382
current-process-send 40
current-process-send 40
default-library 384
default-library 384
define-color-alias 246, 1226
define-color-alias 246, 1226
define-font-alias 1042
define-font-alias 1042
defpackage 6
defpackage 6
delete-color-translation 246, 247, 1229
delete-color-translation 246, 247, 1229
deriver 106, 221
deriver 106, 221
destroy 106
destroy 106
destroy-pixmap-port 1043
destroy-pixmap-port 1043
detach-simple-sink 400
detach-simple-sink 400
detach-sink 401
detach-sink 401
display 7, 8, 39, 271, 402
display 7, 8, 39, 271, 402
display-dialog 163, 167, 404
display-dialog 163, 167, 404
display-message 9, 154, 407
display-message 9, 154, 407
display-message-for-pane 408
display-message-for-pane 408
display-message-on-screen 408
display-message-on-screen 408
display-non-focus-message 409
display-non-focus-message 409
display-pane-selected-text 413
display-pane-selected-text 413
display-pane-selection 414
display-pane-selection 414
display-pane-selection-p 414
display-pane-selection-p 414
display-popup-menu 123, 415
display-popup-menu 123, 415
display-replacable-dialog 416
display-replacable-dialog 416
dither-color-spec 1043
dither-color-spec 1043
docking-layout-pane-docked-p 422
docking-layout-pane-visible-p 423
docking-layout-pane-visible-p 423
drag-pane-object 429
drag-pane-object 429
draw-arc 212, 1044
draw-arc 212, 1044
draw-arcs 212, 1045
draw-arcs 212, 1045
draw-character 212, 1046
draw-character 212, 1046
draw-circle 175, 1047
draw-circle 175, 1047
draw-ellipse 212, 1048
draw-ellipse 212, 1048
draw-image 219, 220, 1049
draw-image 219, 220, 1049
draw-line 212, 1052
draw-line 212, 1052
draw-lines 212, 1053
draw-lines 212, 1053
draw-metafile 431
draw-metafile 431
draw-metafile-to-image 432
draw-metafile-to-image 432
draw-path 213, 1053
draw-path 213, 1053
draw-pinboard-layout-objects 434
draw-pinboard-layout-objects 434
draw-point 178, 1057
draw-point 178, 1057
draw-points 1058
draw-points 1058
draw-polygon 212, 1059
draw-polygon 212, 1059
draw-polygons 212, 1060
draw-polygons 212, 1060
draw-rectangle 212, 1061
draw-rectangle 212, 1061
draw-rectangles 212, 1062
draw-rectangles 212, 1062
draw-string 212, 1063
draw-string 212, 1063
drop-object-allows-drop-effect-p 438
drop-object-allows-drop-effect-p 438
drop-object-collection-index 439
drop-object-collection-index 439
drop-object-collection-item 440
drop-object-collection-item 440
drop-object-drop-effect 441
drop-object-drop-effect 441
drop-object-get-object 442
drop-object-get-object 442
drop-object-provides-format 444
drop-object-provides-format 444
drop-object-provides-for-
mat 444
drop-object-provides-for-
mat 444
defeditor-pane-default-compo-
sition-callback 26, 459
defeditor-pane-default-compo-
sition-callback 26, 459
defeditor-pane-native-blink-
rate 26, 462
defeditor-pane-native-blink-
rate 26, 462
defeditor-pane-selected-text 26
defeditor-pane-selected-text 26
editor-pane-selected-text-p
26
element-container 470
element-screen 471
ensure-color 245, 1229
ensure-gdiplus 1064
ensure-gray 1231
ensure-hav 1231
ensure-interface-screen 472
ensure-model-color 245, 1230
ensure-rgb 1231
execute-with-interface 39, 97, 473
execute-with-interface-if-alive 39, 97, 474
exit-confirmer 163, 165, 476
exit-dialog 165, 167, 477
external-image-color-table 1067
externalize-and-write-image 221, 1068
externalize-image 222, 1070
filtering-layout-match-object-and-exclude-p 484
find-best-font 217, 1072
find-matching-fonts 217, 1073
fit-object 1185
font-description 1076
font-description-attributes 1077
font-description-attribute-value 1076
font-dual-width-p 1077
font-fixed-width-p 1078
font-single-width-p 1079
force-objects-redraw 1189
force-screen-update 487
force-update-all-screens 488
free-image 219, 223, 1080
free-image-access 225, 1080
free-metatile 490
free-sound 491
general-handle-event 40
generate-bar-chart 1190
generate-graph-from-graph-spec 1205
generate-graph-from-pairs 1193
generate-grid-lines 1194
generate-labels 1199
get-all-color-names 243, 1232
get-bounds 1081
get-character-extent 1084
get-char-ascent 1082
get-char-descent 1083
get-char-width 1083
get-color-alias-translating 246, 1233
get-color-spec 243, 1234
get-constraints 71, 492
get-enclosing-rectangle 1084
get-font-ascent 1085
get-font-average-width 1085
get-font-descent 1086
get-font-height 1086
get-font-width 1087
get-page-area 251, 494
get-printer-metrics 251, 495
get-string-extent 1089
get-transform-scale 1090
graphics-port-background 1090
graphics-port-font 1090
graphics-port-foreground 1090
graphics-port-transform 1090
graphics-state-background 1097
graphics-state-compositing-mode 1097
graphics-state-dash 1097
graphics-state-dashed 1097
graphics-state-fill-style 1097
graphics-state-font 1097
graphics-state-foreground 1097
graphics-state-line-end-style 1097
graphics-state-line-joint-style 1097
graphics-state-mask 1097
graphics-state-mask-transparent-form 1097
graphics-state-mask-x 1097
graphics-state-mask-y 1097
graphics-state-operation 1097
graphics-state-pattern 1097
graphics-state-scale-thickness 1097
graphics-state-shape-mode
make-image-locator 613
make-instance 5
make-menu-for-pane 123, 613
make-pinboard-objects-displayer 1209
make-resource-image-set 617
make-rgb 243, 1238
make-scaled-general-image-set 618
make-scaled-image-set 619
make-sorting-description 620
make-sub-image 223, 1125
make-transform 1126
map-typeout 630
merge-font-descriptions 218, 1127
modify-editor-pane-buffer 26, 651
modify-multi-column-list-panel-columns 651
non-focus-list-add-filter 660
non-focus-list-remove-filter 660
non-focus-list-toggle-enable-filter 661
non-focus-list-toggle-filter 660
offset-rectangle 1128
ole-control-add-verbs 665
ole-control-close-object 665
ole-control-i-dispatch 670
ole-control-insert-object 670
ole-control-ole-object 671
ole-control-pane-frame 674
ole-control-user-component 676
ordered-rectangle-union 1128
output-pane-cached-display-user-info 695
output-pane-cache-display 694
output-pane-draw-from-cached-display 696
output-pane-free-cached-display 697
output-pane-stop-composition 699
page-setup-dialog 250, 701
pane-can-restore-display-p 705
pane-close-display 705
pane-descendant-child-with-focus 706
pane-modifiers-state 710
pane-restore-display 715
pane-screen-internal-geometry 41, 151, 715
pane-supports-menues-with-images 122, 718
pinboard-object-highlighted-p 734
pixblt 1130
play-sound 738
popup-confirm 163, 165, 167, 738
popup-menu-force-popdown 124, 749
port-graphics-state 1132
port-height 1133
port-owner 1133
port-string-height 1134
port-string-width 1134
port-width 1135
position-and-fit-object 1185
position-object 1185
postmultiply-transforms 1135
premultiply-transforms 1136
print-dialog 163, 250, 753
print-editor-buffer 26, 252, 755
printer-configuration-dialog 253, 758
printer-metrics-device-height 759
printer-metrics-device-width 759
printer-metrics-dpi-x 759
printer-metrics-dpi-y 759
printer-metrics-height 760
printer-metrics-left-margin 760
printer-metrics-max-height 760
printer-metrics-max-width 760
printer-metrics-min-left-margin 760
printer-metrics-min-top-margin 760
printer-metrics-paper-height 760
printer-metrics-paper-width 760
printer-metrics-top-margin 760
printer-metrics-width 760
printer-port-handle 761
printer-port-supports-port 762
print-file 252, 755
print-rich-text-pane 756
print-text 252, 757
process-pending-messages 763
process-send 40
prompt-for-color 160, 765
prompt-for-confirmation 155, 766
prompt-for-directory 160, 767
prompt-for-file 159, 163, 769
prompt-for-files 773
prompt-for-font 160, 774
prompt-for-form 161, 775
prompt-for-forms 776
prompt-for-integer 156, 165, 778
prompt-for-items-from-list 779
prompt-for-number 157, 780
prompt-for-string 155, 163, 781
prompt-for-symbol 161, 783
prompt-for-value 784
prompt-with-list 157, 786
prompt-with-list-non-focus 172, 789
prompt-with-message 795
quit 351
quit-interface 106, 799
raise-interface 803
range-set-sizes 805
read-and-convert-external-image 223, 1136
read-color-db 247, 1239
read-external-image 1137
read-sound-file 806
rectangle-union 1143
recurve-compute-drawing-object 1181
redisplay-interface 166
redisplay-menu-bar 809
redraw-drawing-with-cached-display 810
redraw-pinboard-layout 811
redraw-pinboard-object 812
register-image-load-function 1144
register-image-translation 223, 1145
remove-capi-object-property 813
replace-dialog 815
reset-image-translation-table 1146
reuse-interfaces-p 817
rich-text-pane-character-format 821
rich-text-pane-operation 822
rich-text-pane-paragraph-format 826
rich-text-version 826
rotate-object 1185
sample 11
save-image 221
screen-active-interface 832
screen-active-p 832
screen-internal-geometries 41, 151, 152, 833
screen-internal-geometry 42, 834
screen-logical-resolution 836
screen-monitor-geometries 41, 151, 836
screens 837
scroll 100
selection 844
selection-empty 845
separation 1146
set-application-interface 846
set-application-themed 267
set-clipboard 848
set-composition-placement 849
set-confirm-quitting 850
set-default-editor-pane-blink-rate 26, 851
set-default-image-load-function 1147
set-default-interface-prefix-suffix 18, 852
set-default-use-native-input-method 854
set-drop-object-supported-formats 855
set-editor-parenthesis-colors 26, 857
setf 18, 32
set-geometric-hint 79, 858
set-graphics-port-coordinates 1148
set-graphics-state 211, 1149
set-hint-table 79, 87, 858
set-horizontal-scroll-parameters 80
set-interactive-break-features 860
set-list-panel-keyboard-search-reset-time 861
set-object-automatic-resize 862
set-printer-metrics 251, 867
set-printer-options 250, 868
set-rich-text-pane-character-format 870
set-rich-text-pane-paragraph-format 873
set-selection 875
set-top-level-interface-geometry 98
set-vertical-scroll-parameters 80
show-interface 881
show-pane 881
simple-pane-handle 895
simple-pane-visible-height 28
simple-pane-visible-size 28
simple-pane-visible-width 28
simple-print-port 206, 252, 898
slot-value 5
sorted-object-sorted-by 905
sort-object-items-by 903
start-drawing-with-cached-display 906
start-gc-monitor 909
static-layout-child-geometry 911
stop-gc-monitor 914
stop-sound 915
tab-layout-panes 922
tab-layout-visible-child 923
text-input-pane-append-recent-items 941
text-input-pane-complete-text 942
text-input-pane-copy 943
text-input-pane-cut 944
text-input-pane-delete 944
text-input-pane-delete-recent-items 941
text-input-pane-in-place-complete 945
text-input-pane-paste 945
text-input-pane-prepend-recent-items 941
text-input-pane-recent-items 946
text-input-pane-replace-recent-items 941
text-input-pane-recent-items 949
top-level-interface-geometry 42, 99, 151
top-level-interface-geometry-display-state 105
transform-area 1150
transform-distance 1151
transform-distances 1151
transform-is-rotated 1152
transform-point 1152
transform-points 1153
transform-rect 1154
tree-view-ensure-visible 990
tree-view-item-checkbox-status 991
tree-view-item-children-checkbox-status 992
unconvert-color 225, 1240
undefine-font-alias 1154
unhighlight-pinboard-object 994
uninstall-postscript-printer 995
unit-transform-p 1156
unmap-typeout 996
untransform-distance 1157
untransform-distances 1158
untransform-point 1159
untransform-points 1159
update-all-interface-titles 996
update-drawing-with-cached-
invalidate-rectangle 1112
item 571
item-pane-interface-copy-object 569
list-panel-enabled 589
list-panel-filter-state 589
list-panel-unfiltered-items 593
locate-interface 606
make-container 608
make-image-access 1123
make-pane-popup-menu 123, 615
manipulate-pinboard 622
map-collection-items 625
map-pane-children 626
map-pane-descendant-children 629
merge-menu-bars 648
move-line 653
non-focus-maybe-capture-gesture 662
non-focus-terminate 663
non-focus-update 664
output-pane-resize 698
over-pinboard-object-p 700
pane-adjusted-offset 702
pane-adjusted-position 703
pane-has-focus-p 707
pane-initial-focus 708
pane-interface-copy-object 709
pane-interface-copy-p 709
pane-interface-cut-object 709
pane-interface-cut-p 709
pane-interface-deselect-all 709
pane-interface-deselect-all-p 709
pane-interface-paste-object 709
pane-interface-paste-p 709
pane-interface-select-all 709
pane-interface-select-all-p 709
pane-interface-undo 709
pane-interface-undo-p 709
pane-popup-menu-items 123, 712
pane-string 717
parse-layout-descriptor 718
pinboard-layout-display 725
pinboard-object-at-position 732
pinboard-object-graphics-arg 733
pinboard-object-overlap-p 735
pinboard-pane-position 735
pinboard-pane-size 737
port-drawing-mode-quality-p 1131
print-capi-button 751
print-collection-item 752
record-dependent-object 806
redisplay-collection-item 808
redisplay-interface 809
reinitialize-interface 812
remove-items 814
replace-items 815
report-active-component-failure 816
scroll 838
scroll-if-not-visible-p 102, 842
search-for-item 843
set-button-panel-enabled-items 847
set-display-pane-selection 854
set-horizontal-scroll-parameters 859
set-pane-focus 867
set-scroll-position 839
set-scroll-range 860, 878
set-text-input-pane-selection 876
set-top-level-interface-geometry 876
set-vertical-scroll-parameters 878
simple-pane-visible-height 895
simple-pane-visible-size 896
simple-pane-visible-width 897
sorted-object-sort-by 904
static-layout-child-position 912
static-layout-child-size 913
switchable-layout-switchable-children 917
top-level-interface 972
top-level-interface-display-state 972
top-level-interface-geometry 974
top-level-interface-geometry-key 975
top-level-interface-p 977
top-level-interface-save-geometry-p 977
tree-view-expanded-p 990
tree-view-update-an-item 993
tree-view-update-item 993
unrecord-dependent-object 806
update-interface-title 999
validate-rectangle 1160
generic properties of elements 11–12
geometry of interfaces 151
generics of interfaces, querying 41
geometry of layouts, specifying 85–86
geometry slots
%child% 1013
%height% 1012
%max-height% 1012
%max-width% 1012
%min-height% 1012
%min-width% 1012
%object% 1013
%scroll-height% 1013
%scroll-horizontal-page-size% 1013
%scroll-horizontal-slug-size% 1013
%scroll-horizontal-step-size% 1013
%scroll-start-x% 1013
%scroll-start-y% 1013
%scroll-vertical-page-size% 1013
%scroll-vertical-slug-size% 1013
%scroll-vertical-step-size% 1013
%scroll-width% 1013
%scroll-x% 1013
%scroll-y% 1013
%width% 1012
%y% 1012
:geometry-change-callback

initarg 529
geometry-drawing-object class
1201
:gesture-callbacks initarg 480, 926
get pane
interface 388
get-all-color-names function 243, 1232
get-bounds function 1081
get-character-extent function 1084
get-char-ascent function 1082
get-char-descent function 1083
get-char-width function 1083
get-collection-item generic function 491
get-color-alias-translation function 246, 1233
get-color-spec function 243, 1234
get-constraints function 71, 492
get-enclosing-rectangle function 1084
get-font-ascent function 1085
get-font-average-width function 1085
get-font-descent function 1086
get-font-height function 1086
get-font-width function 1087
get-graphics-state function 1087
get-horizontal-scroll-parameters generic function 493
get-origin function 1088
get-page-area function 251, 494
get-pane 388
get-printer-metrics function 251, 495
get-scroll-position generic function 496
get-string-extent function 1089
get-transform-scale function 1090
get-vertical-scroll-parameters generic function 497

graph panes
callbacks 58
graph-edge class 498
graph-edge-from accessor 60
graph-edge-from accessor function 498
graph-edge-to accessor 60
graph-edge-to accessor function 498
Graphic Tools
higher level 236
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>lower level</td>
<td>229</td>
</tr>
<tr>
<td>graphic tools</td>
<td>286</td>
</tr>
<tr>
<td>self-contained examples</td>
<td>229</td>
</tr>
<tr>
<td>graphics</td>
<td>205</td>
</tr>
<tr>
<td>automatic redrawing</td>
<td>176</td>
</tr>
<tr>
<td>creating permanent displays</td>
<td>207</td>
</tr>
<tr>
<td>displaying</td>
<td>213</td>
</tr>
<tr>
<td>graphics ports</td>
<td>209</td>
</tr>
<tr>
<td>drawing functions</td>
<td>215</td>
</tr>
<tr>
<td>pixmap</td>
<td>216</td>
</tr>
<tr>
<td>graphics state</td>
<td>209</td>
</tr>
<tr>
<td>graphics state parameters</td>
<td>211</td>
</tr>
<tr>
<td>:graphics-args initarg 188, 727</td>
<td>1090</td>
</tr>
<tr>
<td>:graphics-options initarg 682</td>
<td></td>
</tr>
<tr>
<td>graphics-port-background function</td>
<td>1090</td>
</tr>
<tr>
<td>graphics-port-font function 1090</td>
<td></td>
</tr>
<tr>
<td>graphics-port-foreground function</td>
<td>1090</td>
</tr>
<tr>
<td>graphics-port-mixin class 1091</td>
<td></td>
</tr>
<tr>
<td>graphics-port-transform function</td>
<td>1090</td>
</tr>
<tr>
<td>graphics-state structure class</td>
<td>1092</td>
</tr>
<tr>
<td>graphics-state type 210, 211</td>
<td></td>
</tr>
<tr>
<td>graphics-state-background function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-compositing-mode function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-dash function 1097</td>
<td></td>
</tr>
<tr>
<td>graphics-state-dashed function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-fill-style function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-font function 1097</td>
<td></td>
</tr>
<tr>
<td>graphics-state-foreground function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-line-end-style function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-line-joint-style function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-mask-transform function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-mask-x function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-mask-y function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-operation function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-pattern function</td>
<td></td>
</tr>
<tr>
<td>graphics-state-scale-thickness function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-shape-mode function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-stipple function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-text-mode function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-thickness function</td>
<td>1097</td>
</tr>
<tr>
<td>graphics-state-transform function</td>
<td>1097</td>
</tr>
<tr>
<td>graph-node class</td>
<td>499</td>
</tr>
<tr>
<td>graph-node-children generic function</td>
<td>191</td>
</tr>
<tr>
<td>graph-node-height accessor 60</td>
<td></td>
</tr>
<tr>
<td>graph-node-height accessor function</td>
<td>499</td>
</tr>
<tr>
<td>graph-node-in-edges accessor 59</td>
<td></td>
</tr>
<tr>
<td>graph-node-in-edges accessor function</td>
<td>499</td>
</tr>
<tr>
<td>graph-node-out-edges accessor 59</td>
<td></td>
</tr>
<tr>
<td>graph-node-out-edges accessor function</td>
<td>499</td>
</tr>
<tr>
<td>graph-node-width accessor 60</td>
<td></td>
</tr>
<tr>
<td>graph-node-width accessor function</td>
<td>499</td>
</tr>
<tr>
<td>graph-node-x accessor 60</td>
<td></td>
</tr>
<tr>
<td>graph-node-x accessor function 499</td>
<td></td>
</tr>
<tr>
<td>graph-node-y accessor 60</td>
<td></td>
</tr>
<tr>
<td>graph-node-y accessor function 499</td>
<td></td>
</tr>
<tr>
<td>graph-object class</td>
<td>500</td>
</tr>
<tr>
<td>graph-object-element accessor function</td>
<td>500</td>
</tr>
<tr>
<td>graph-object-object accessor function</td>
<td>500</td>
</tr>
<tr>
<td>graph-pane class</td>
<td>500</td>
</tr>
<tr>
<td>implementation of 191</td>
<td></td>
</tr>
<tr>
<td>graph-pane-add-graph-node generic function</td>
<td>505</td>
</tr>
<tr>
<td>graph-pane-delete-object generic function</td>
<td>506</td>
</tr>
<tr>
<td>graph-pane-delete-objects generic function</td>
<td>506</td>
</tr>
<tr>
<td>graph-pane-delete-selected-objects generic function</td>
<td>507</td>
</tr>
<tr>
<td>graph-pane-direction accessor 59</td>
<td></td>
</tr>
<tr>
<td>graph-pane-direction generic function</td>
<td>507</td>
</tr>
<tr>
<td>graph-pane-edges function 508</td>
<td></td>
</tr>
<tr>
<td>graph-pane-layout-function</td>
<td></td>
</tr>
</tbody>
</table>
accessor 59

**graph-pane-layout-function** accessor function 501
**graph-pane-nodes** function 509
**graph-pane-object-at-position** function 509
**graph-pane-roots** accessor function 56
**graph-pane-roots** accessor function 501
**graph-pane-select-graph-nodes** generic function 510
**graph-pane-update-moved-objects** generic function 511

**grid**  example 283
prototype implementation 283
groupbox 18, 956
GTK+ resources 375, 376, 467, 861

**HTML**
displaying 28
HWND 379, 895

**I**
:iconify-callback initarg 529
:ignore-file-suffices initarg 926
image class 219, 1101
image identifiers
  cancel-button 936
  complete-button 936
  ok-button 936
:image initarg 316, 520, 963
image-access-height function 1101
image-access-pixel function 224, 1102
image-access-pixels-from-bgra function 1104
image-access-pixels-to-bgra function 1105
image-access-transfer-from-image function 224, 225, 1106
image-access-transfer-to-image function 225, 1107
image-access-width function 1101
image-freed-p function 1108
:image-function initarg 53, 55, 61, 121, 427, 578, 595, 631, 677, 919, 980
image-height accessor function 224, 1101
:image-height initarg 428, 519, 579, 960, 981
image-list class 53, 55, 518
:image-lists initarg 53, 55, 64, 578, 595, 677, 919, 981
image-loader function 1108
image-locator type 520
image-pinboard-object class 520
image-pinboard-object-image
accessor function 520
images
  alpha channel 278
  copying and pasting 276
  pixel-by-pixel editing 278
  supported formats 220, 221
:images initarg 321, 960, 969
image-set class 521
:image-sets initarg 519
:image-state-function initarg 427
image-translation function 1109
image-width accessor function 224, 1101
:image-width initarg 427, 519, 579, 960, 981
IME 683
index of selected item 53, 63, 338
:init-function initarg 333
:initial-constraints initarg 84, 465
:initial-focus initarg 15, 530, 531, 574
:initial-focus-item initarg 15, 338
initialize-dithers function 1110
:initial-value initarg 156
in-place completion
  in applications 172
  user interface 168
:in-place-completion-function initarg 172, 926
:in-place-filter initarg 172, 926
input focus 14, 292
input method 683
:input-model initarg 275, 682
:insert-callback initarg 672
InsertMenus 557
inset-rectangle function 1110
inside-rectangle function 1111
installed-libraries function 524
install-postscript-printer function 522
integers
  prompting for 156–157
interaction
  general properties 62
  in lists 49
:interaction initarg 49, 61, 62, 112, 158, 316, 337
interaction styles 318
interactions
  for choice 338
  interactive panes 30
interactive-pane class 30, 525
interactive-pane-execute-command generic function 527
interactive-pane-stream accessor function 525
interactive-pane-top-level-function accessor function 525
interactive-stream 526
interactive-stream-stream 526
interactive-stream-top-level-function 526
:interface callback type 63
interface class 2, 18, 35, 70, 138, 528
:interface initarg 465
interface-activate-callback accessor function 532
interface-confirm-destroy-function accessor function 532
interface-create-callback accessor function 532
interface-customize-toolbar function 132, 548
interface-default-toolbar-states accessor function 532
interface-default-toolbar-states function 132
interface-destroy-callback accessor function 532
interface-display generic function 97, 219, 224, 548
interface-display-title function 550
interface-document-modified-p function 530
interface-drop-image accessor function 532
interface-editor-pane generic function 551
interface-extend-title generic function 18, 552
interface-geometry generic function 553
interface-geometry-change-callback accessor function 532
interface-help-callback accessor function 532
interface-iconified-p function 553
interface-iconify-callback accessor function 532, 542
interface-iconize-callback
accessor function 542

interface-keys-style generic function 554

interface-match-p generic function 556

interface-menu-bar-items accessor function 532

interface-menu-groups generic function 557

interface-message-area accessor function 532, 542

interface-override-cursor accessor function 532

interface-pathname accessor function 532

interface-pointer-documentation-enabled accessor function 532

interface-preserve-state generic function 558

interface-preserving-state-p function 559

interface-reuse-p generic function 560

interfaces
defining 138–149
description of 138
layouts, specifying 140
menus, specifying 144–147
panes, specifying 140
specifying geometry 41
title, specifying 140

:interfaces class option 397

:interfaces initarg 830

interface-title accessor function 18, 150, 532

interface-toolbar-items accessor function 532

interface-toolbar-state function 132, 561

interface-toolbar-states accessor function 532

interface-tooltips-enabled accessor function 532

interface-visible-p function 563

interface-window-styles accessor function 532

internal constraints 81
internal scrolling 686

:internal-border initarg 884

:internal-max-height initarg 81, 466, 728

:internal-max-width initarg 81, 466, 728

:internal-min-height initarg 81, 466, 728

:internal-min-width initarg 81, 466, 728

:internet-explorer-callback initarg 305

interpret-description generic function 69, 564

Interrupt playing a MIDI file 915

invalidate-pane-constraints function 565

invalidate-rectangle generic function 1112

invalidate-rectangle-from-points function 1113

invert-transform function 1114

invoke-command function 566

invoke-untranslated-command function 566

item class 567

item-collection accessor function 568

item-data accessor 32

item-data accessor function 568

item generic function 571

item-pane-interface-copy-object generic function 569

item-pinboard-object class 190, 570

item-print-function accessor 32

item-print-function accessor function 568

:item-print-functions initarg 54, 654

:items initarg 47, 114, 357, 419, 479, 631, 636, 918, 989

:items-count-function initarg 357, 479, 989

item-selected accessor function 568

:items-function initarg 389, 631, 636

:items-get-function initarg 357, 479, 989

:items-map-function initarg 357, 479, 989

item-text accessor 32

item-text accessor function 568
K
:keep-selection-p initarg 337
key press 177–186
key press event handler 179, 685
:keyboard-search-callback initarg 54, 578
key-press events 179, 685

L
labelled-arrow-pinboard-object class 571
labelled-line-pinboard-object class 572
labelled-line-text-background accessor function 572
labelled-line-text-foreground accessor function 572
:label-style initarg 480
:large-image-height initarg 596
:large-image-width initarg 595
layout class 573
:layout initarg 529
:layout-args initarg 321
:layout-class initarg 45, 321
:layout-description accessor function 96, 574
*layout-divider-default-size* 366, 829
:layout-function initarg 501
:layout-ratios accessor function 365, 828
layouts
children 69
combining different 77–79
description of 69–86
introduction to 7
layout hierarchy 187
self-contained examples 284
specifying geometry 85–86
specifying size of panes in 74
layouts class option 387
/layouts interface option 138
:layout-x-adjust accessor function 1024
:layout-x-adjust initarg 501
layout-x-gap accessor function 512
layout-x-ratios accessor function 512
layout-y-adjust accessor function 1024
:layout-y-adjust initarg 501
layout-y-gap accessor function 512
layout-y-ratios accessor function 512
:leaf-node-p-function initarg 979
letters
underlined in menus and titles 13
line-end-style graphics state parameter 1095
line-join-style graphics state parameter 1095
line-pinboard-object class 575
line-pinboard-object-coordinates function 576
:line-size initarg 840
:line-wrap-face initarg 449
:line-wrap-marker initarg 449
Lisp forms
prompting for 161
LispWorks as ActiveX control 396, 666
list items, specifying 49
list panels 48
list-all-font-names function 217, 1115
listener panes 31
listener-pane class 31, 75, 600
listener-pane-insert-value function 600
list-known-image-formats function 220, 221, 1115
list-panel class 14, 48, 170, 577
list-panel-enabled generic function 589
list-panel-filter-state generic function 589
list-panel-image-function accessor function 579
list-panel-items-and-filter function 590
list-panel-keyboard-search-callback accessor function 579
list-panel-right-click-selection-behavior accessor function 579
list-panel-search-with-function function 591
list-panel-state-image-function accessor function 579
list-panel-unfiltered-items generic function 593
lists
actions in 50
deselection in 50
extended selection in 49
extended selections 50
<table>
<thead>
<tr>
<th>Interaction in 49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple selection in 49</td>
</tr>
<tr>
<td>Retraction in 50</td>
</tr>
<tr>
<td>Single selection in 49</td>
</tr>
<tr>
<td>List-view class 594</td>
</tr>
<tr>
<td>List-view-auto-arrange-icons accessor function 596</td>
</tr>
<tr>
<td>List-view-auto-reset-column-widths accessor function 596</td>
</tr>
<tr>
<td>List-view-columns accessor function 596</td>
</tr>
<tr>
<td>List-view-image-function accessor function 596</td>
</tr>
<tr>
<td>List-view-state-image-function accessor function 596</td>
</tr>
<tr>
<td>List-view-subitem-function accessor function 596</td>
</tr>
<tr>
<td>List-view-subitem-functions accessor function 596</td>
</tr>
<tr>
<td>List-view-view accessor function 596</td>
</tr>
<tr>
<td>:list-visible-min-height initialization 427</td>
</tr>
<tr>
<td>:list-visible-min-width initialization 427</td>
</tr>
<tr>
<td>Load-color-database function 247, 1235</td>
</tr>
<tr>
<td>Load-cursor function 601</td>
</tr>
<tr>
<td>Load-icon-image function 220, 223, 1116</td>
</tr>
<tr>
<td>Load-image function 223, 1118</td>
</tr>
<tr>
<td>Load-sound function 605</td>
</tr>
<tr>
<td>Locate-interface generic function 606</td>
</tr>
<tr>
<td>Lookup pane interface 388</td>
</tr>
<tr>
<td>Lookup-pane 388</td>
</tr>
<tr>
<td>Lower-interface function 607</td>
</tr>
</tbody>
</table>

**M**

Mac OS X Dock 29, 349, 716

Macros

- defclass 138, 140, 176
- define-color-models 247, 1228
- define-command 384
- define-interface 138, 387
- define-layout 394
- define-menu 395
- define-ole-control-component 396
- display-errors 407
- rectangle-bind 1140
- rectangle-bottom 1140
- rectangle-height 1141
- rectangle-left 1141
- rectangle-right 1142
- rectangle-top 1142
- rectangle-width 1144
- rect-bind 1139
- undefine-menu 994
- union-rectangle 1155
- unless-empty-rectangle 1156
- with-atomic-redisplay 1002
- with-busy-interface 1003
- with-dialog-results 162, 1004
- with-dither 1161
- with-document-pages 250, 1007
- with-external-metafile 206, 1008
- with-geometry 28, 1011
- with-graphics-mask 1162
- with-graphics-post-translation 1163
- with-graphics-rotation 1164
- with-graphics-scale 1164
- with-graphics-state 211, 1166
- with-graphics-transform 1167
- with-graphics-transform-reset 1168
- with-graphics-translation 1164
- with-internal-metafile 206, 1014
- with-inverse-graphics 1169
- with-output-to-printer 252, 1016
- without-relative-drawing 1175
- with-page 250, 1017
- with-page-transform 251, 1018
- with-pixmap-graphics-port 206, 227, 1170
- with-print-job 206, 250, 1019
- with-random-typeout 1021
- with-transformed-area 1171
- with-transformed-point 1172
- with-transformed-points 1173
- with-transformed-rect 1174
- make-absolute-drawing function 1185
- make-absolute-drawing* function
description of 109–122
disabling items in 120–121
Edit 122
grouping items together 111–114
individual items in 114–115
menu hierarchy 115
nesting 111
Right button 122, 131, 416, 420, 421,
541, 631
specifying alternative items 119
:menus class option 388
:menus interface option 138, 144
menu-title accessor function 645
menu-title-function accessor
function 645
merge-font-descriptions function
218, 1127
merge-menu-bars generic function
648
:message initarg 955
:message-area initarg 530
:message-callback initarg 349
:message-gap initarg 955
message-pane class 650
metafile-port class 650
metafiles 278
Microsoft Windows
Multiple-Document Interface 92
themes 267
MIDI files
interrupting 915
:min keyword argument 156
:min-column-width initarg 512
%min-height% geometry slot 1012
:min-height initarg 82
:min-row-height initarg 512
%min-width% geometry slot 1012
:min-width initarg 82
:mnemonic initarg 13, 34, 316, 322,
631, 639
:mmnemonic-escape initarg 317, 322,
631, 639
mnemonics 13
in a button-panel 46
in menus 117
:mmemonics initarg 46
:mmemonic-text initarg 34, 317, 322
:mmemonic-title initarg 14, 322,
631, 639, 955
modal dialogs 161, 405, 742, 1005
modify-editor-pane-buffer
function 26, 651
modify-multi-column-list-
panel-columns function 651
mono-screen class 653
Motif
resources 272
Motif resources 467
mouse clicks 179, 685
mouse coordinates 380
mouse cursor
tracking 199
mouse events 179, 685
mouse position 380
move-line generic function 653
multi-column-list-panel class
654
multi-line-text-input-pane
class 22, 659
Multiple Document Interface 137, 374, 380,
424
:multiple-selection interaction
style 49, 61, 62, 114, 317
multi-touch support 182
N
:name initarg 333
:names initarg 960, 969
:natural-height initarg 1211
:natural-width initarg 1211
:navigate-complete-callback
initarg 304
:navigate-error-callback ini-
targ 305
:navigation-callback initarg 926
New in LispWorks 7.0
apply-drawing-object class 1178
as-dialog argument to contain 371
basic-graph-spec structure class
1179
basic-graph-spec-p function
1205
browser-pane-available-p
function 312
Cached Display interface 684
color-from-premultiplied
function 1220
color-to-premultiplied function
1221
compound-drawing-object class
1180
compute-drawing-object-
from-data function 1181
copy-basic-graph-spec function
create-dummy-graphics-port  function 378
*default-non-focus-message-timeout* variable 383
*default-non-focus-message-timeout-extension* variable 383
destroy-dependent-object  generic function 399
drawing-object  class 1183
draw-pinboard-layout-objects  function 434
draw-pinboard-layout-displayer  function 1209
draw-pinboard-objects-displayer  function 1210
draw-pinboard-objects-displayer  class 1201
edit-pane  supports variable-width fonts on Cocoa 453
element example combining an XML parser with tree-view to display an RSS file 989
edit-pane  supports variable-width fonts on Cocoa 539, 973
generate-bar-chart  function 1190
generate-graph-from-graph-spec  function 1205
generate-graph-from-pairs  function 1193
generate-labels  function 1199
generate-labels  class 1201
geometry-drawing-object  class 1201
geometry-drawing-object  class 1201
graphic tools 1177
graphics-port-mixin  class 1091
:image-function  initarg for double-list-panel 427
:image-height  initarg for double-list-panel 428
:image-locator  type 520
:image-state-function  initarg for double-list-panel 427
:image-width  initarg for double-list-panel 427
input-model of output-pane supports modifier changes 179, 685
invalidate-rectangle-from-points  function 1113
:list-visible-min-height  initarg for double-list-panel 427
:list-visible-min-width  initarg for double-list-panel 427
make-absolute-drawing  function 1185
make-absolute-drawing  function 1185
make-a-drawing-call  function 1202
make-basic-graph-spec  function 1205
make-draw-arc  function 1202
make-draw-circle  function 1202
make-draw-ellipse  function 1202
make-draw-line  function 1202
make-draw-lines  function 1202
make-draw-polygon  function 1202
make-draw-rectangle  function 1202
make-draw-string  function 1207
make-pinboard-objects-displayer  function 1209
multi-touch support 182
:name  initarg 265
:name  initarg for toolbar 960
:name  initarg for toolbar-component 969
:no-highlight  initarg 727
objects-displayer  class 1210
object-sort-caller  argument to make-sorting-description 620
output-pane-cached-display-user-info  function 695
output-pane-cache-display  function 694
output-pane-draw-from-cached-display  function 696
output-pane-free-cached-display  function 697
output-pane-resize  generic function 698
output-pane-stop-composition  function 699
accessor 1211
off screen 205
offset-rectangle function 1128
ok item in :buttons initarg 933
ok-button image identifier 936
ok-check keyword argument 156, 161, 167
OLE control 396, 666
OLE embedding 396, 666
ole-control-add-verbs function 665
ole-control-close-object function 665
ole-control-component class 29, 666
ole-control-component-pane accessor function 666
ole-control-doc class 668
ole-control-frame class 669
ole-control-i-dispatch function 670
ole-control-insert-object function 670
ole-control-ole-object function 671
ole-control-pane class 29, 672
ole-control-pane-frame function 674
ole-control-pane-simple-sink class 675
ole-control-user-component function 676
operation graphics state parameter 210, 1093
option panes 60
option-pane class 14, 60, 677
option-pane-enabled accessor function 678
option-pane-enabled-positions accessor function 678
option-pane-image-accessor function 678
option-pane-popup-callback accessor function 678
option-pane-separator-item accessor function 678
option-pane-visible-items-count accessor function 678
ordered-rectangle-union function 1128
ordinary scrolling 686
organizing panes 72
orientation initarg 419, 512, 804
orientation item in :buttons initarg 935
output-pane class 26, 35, 80, 122, 173, 199, 205, 206, 242, 249, 682
output-pane-cached-display-user-info function 695
output-pane-cache-display function 694
output-pane-composition-callback accessor function 684
output-pane-create-callback accessor function 684
output-pane-destroy-callback accessor function 684
output-pane-display-callback accessor function 684
output-pane-draw-from-cached-display function 696
output-pane-focus-callback accessor function 684
output-pane-free-cached-display function 697
output-pane-graphics-options accessor function 684
output-pane-input-model accessor 186, 685
output-pane-input-model accessor function 684
output-pane-resize generic function 698
output-pane-resize-callback accessor function 684
output-pane-scroll-callback accessor function 684
output-pane-stop-composition function 699
over-pinboard-object-p generic function 700
override-cursor initarg 530
P
page-setup-dialog function 250, 701
page-size initarg 840
page-adjusted-offset generic function 702
panel-adjusted-position
generic function 703
:pane-args initarg 139
pane-can-restore-display-p
function 705
:pane-can-scroll initarg 201, 683
pane-close-display function 705
pane-descendant-child-with-focus function 706
:pane-function initarg 666
pane-got-focus generic function 707
pane-has-focus-p generic function 707
pane-initial-focus generic function 708
pane-interface-copy-object
generic function 709
pane-interface-copy-p generic
function 709
pane-interface-cut-object
generic function 709
pane-interface-cut-p generic
function 709
pane-interface-deselect-all
generic function 709
pane-interface-deselect-all-p generic
function 709
pane-interface-paste-object
generic function 709
pane-interface-paste-p generic
function 709
pane-interface-select-all
generic function 709
pane-interface-select-all-p generic
function 709
pane-interface-undo generic
function 709
pane-interface-undo-p generic
function 709
panel
button layout 45
pane-layout accessor function 95, 322, 532
panels
check button 46
list 48
push button 44
radio button 45
:pane-menu initarg 122, 884, 953
pane-modifiers-state function
710
pane-popup-menu-items generic
function 123, 712
pane-restore-display function 715
panes
accessing 142
accessing 30
creating your own 173–198
default title position 18
display 20
editor 23
finding 142
graphs 56
interactive 30
listener 31
lookup 142
option 60
organizing 72
sizing 74
text input 21
title 17
:panes class option 387
:panes interface option 138
pane-screen-internal-geometry
function 41, 151, 715
pane-string generic function 717
pane-supports-menus-with-images
function 122, 718
:paragraph-format initarg 818
:parent initarg 465
parse-layout-descriptor generic
function 718
password-pane class 720
password-pane-overwrite-character
accessor function 720
paste
defining operation for your interface
class 105
operation on active element 104
path 1053
:pathname initarg 531
:pathname keyword argument 160
pattern graphics state parameter 1094
pi-by-2 constant 1129
pinboard
buffered display 191
double buffering 191
flickering 191
:pinboard initarg 727
pinboard objects 187
creating your own 194–198
pinboard-layout class 35, 77, 187,
printer-port-handle function
761
printer-port-supports-p function
762
*printer-search-path* variable
762
print-file function 252, 755
:print-function initarg 32, 43,
281, 357, 567, 900, 918
printing
on multiple pages 286
self-contained examples 286
print-rich-text-pane function
756
print-text function 252,
757
process
CAPI 402
Cocoa Event Loop 403
process-send function 40
progress-bar class 29, 764
prompt-for-color function 160,
765
prompt-for-confirmation function
155, 766
prompt-for-directory function
160, 767
prompt-for-file function 159,
163, 769
prompt-for-files function 773
prompt-for-font function 160, 774
prompt-for-form function 161, 775
prompt-for-forms function 776
prompt-for-integer function 156,
165, 778
prompt-for-items-from-list function
779
prompt-for-number function 157,
780
prompt-for-string function 155,
163, 781
prompt-for-symbol function 161,
783
prompt-for-value function 784
prompt-with-list function 157,
786
prompt-with-list-non-focus function 172, 789
prompt-with-message function 9,
795
:protected-callback initarg 819
push button panels
creating 44
push buttons 32
push-button class 32, 44, 796
push-button-panel class 44, 798
Q
quit function 351
quit-interface function 106, 799
R
radio button panels
creating 45
radio buttons 33
radio-button class 34, 801
radio-button-panel class 44, 45,
62, 802
raise-interface function 803
range-callback accessor function 804
range-end accessor function 804
range-orientation accessor func-
tion 804
range-pane class 29, 804
range-set-sizes function 805
range-slug-end accessor function 804
range-slug-start accessor function
804
range-start accessor function 804
:ratios initarg 365, 828
read-and-convert-external-
image function 223, 1136
read-color-db function 247, 1239
:reader slot option 142
read-external-image function 1137
read-sound-file function 806
:recent-items initarg 927
:recent-items-mode initarg 927
:recent-items-name initarg 927
record-dependent-object generic
function 806
rectangle class 807
rectangle-bind macro 1139
rectangle-bottom macro 1140
rectangle-height macro 1141
rectangle-left macro 1141
rectangle-right macro 1142
rectangle-top macro 1142
rectangle-union function 1143
rectangle-width macro 1144
rect-bind macro 1139
recurse-compute-drawing-
object function 1181
red Close button
on Cocoa 151, 550
redisplay
efficiency issues 40
of choices 40
of items 40
of pinboards 40
of several updates together 41
redisplay-collection-item
generic function 808
redisplay-interface function 166
redisplay-interface function 809
redisplay-menu-bar function 809
redraw-drawing-with-cached-display function 810
redraw-pinboard-layout function 811
redraw-pinboard-object function 812
register-image-load-function
function 1144
register-image-translation
function 223, 1145
reinitialize-interface generic function 812
:remapped initarg 963
remove-capi-object-property
function 813
remove-items generic function 814
replace-dialog function 815
replace-items generic function 815
reset-active-component-failure generic function 816
reset-image-translation-table function 1146
resizable
dialogs 539
elements 468
tiny 534
:resize-callback initarg 683, 698
resizing 468, 534, 539
resolution
of display 836
of printer 495
Resources
GTK+ 269
X11/Motif 272
:retain-expanded-nodes initarg 979
:retract-callback initarg 32, 33,
51, 58, 63, 318, 329
Return key 740
reuse-interfaces-p function 817
rich-text-pane class 27, 818
rich-text-pane-change-callback accessor function 819
rich-text-pane-character-format function 821
rich-text-pane-limit accessor function 819
rich-text-pane-operation function 822
rich-text-pane-paragraph-format function 826
rich-text-pane-text accessor function 819
rich-text-version function 826
Right button menu 122, 131, 416, 420, 421, 541, 631
right-angle-line-pinboard-object class 827
right-button menu 283
:right-click-extended-match
initarg 979
:right-click-selection-behavior initarg 577
:roots initarg 56, 501, 979
rotate-object function 1185
row-layout class 45, 72, 828
row-layout-divider 829
:rows initarg 512
S
save-image function 221
:save-name initarg 672
scale
for a printer 495
scale-thickness graphics state parameter 1095
scaling
while printing 1018
screen
usable region of 834
screen class 830
screen-active-interface function 832
screen-active-p function 832
screen-depth accessor function 831
screen-height accessor function 831
screen-height-in-millimeters accessor function 831
screen-interfaces accessor func-
screen-internal-geometries function 41, 151, 152, 833
screen-internal-geometry function 42, 834
screen-logical-resolution function 836
screen-monitor-geometries function 41, 151, 836
screen-number accessor function 831
screens function 837
screentips 35
screen-width accessor function 831
screen-width-in-millimeters accessor function 831
scroll bars
programmatic control 100
specifying 12
scroll generic function 100, 838
scroll-bar class 29, 840
scroll-bar-line-size accessor function 840
scroll-bar-page-size accessor function 840
:scroll-callback initarg 200, 276, 682
%scroll-height% geometry slot 1013
:scroll-height initarg 80, 200, 885
%scroll-horizontal-page-size% geometry slot 1013
:scroll-horizontal-page-size initarg 885
%scroll-horizontal-slug-size% geometry slot 1013
:scroll-horizontal-slug-size initarg 885
%scroll-horizontal-step-size% geometry slot 1013
:scroll-horizontal-step-size initarg 885
scroll-if-not-visible-p
generic function 102, 842
:scroll-if-not-visible-p initarg 885
scrolling 276
built-in 496
internal 686
ordinary 686
:scroll-initial-x initarg 885
:scroll-initial-y initarg 885
%scroll-start-x% geometry slot 1013
:scroll-start-x initarg 885
%scroll-start-y% geometry slot 1013
:scroll-start-y initarg 885
%scroll-vertical-page-size% geometry slot 1013
:scroll-vertical-page-size initarg 885
%scroll-vertical-slug-size% geometry slot 1013
:scroll-vertical-slug-size initarg 885
%scroll-vertical-step-size% geometry slot 1013
:scroll-vertical-step-size initarg 885
%scroll-width% geometry slot 1013
:scroll-width initarg 80, 200, 885
%scroll-x% geometry slot 1013
%scroll-y% geometry slot 1013
:search-field initarg 22, 927
search-for-item generic function 843
:selected initarg 33, 316, 567
:selected-disabled-image initarg 316
:selected-disabled-images initarg 316
:selected-function initarg 639
:selected-image initarg 316, 963
:selected-images initarg 321
:selected-item initarg 60, 63, 337, 989
:selected-item-function initarg 636, 969
:selected-items initarg 63, 337
:selected-items-filter initarg 427
:selected-items-function initarg 636, 969
:selected-item-title initarg 427
selecting nth item 53, 63, 338
selection function 844
selection gesture 50
:selected initarg 63, 337
:selection-callback initarg 32, 49, 51, 58, 63, 148, 318, 329, 919
selection-empty function 845
:selection-function initarg 636, 969
set-selection function 875
set-text-input-pane-selection generic function 876
set-top-level-interface-geometry function 98
set-top-level-interface-geometry generic function 876
:setup-callback-argument initarg 645
set-vertical-scroll-parameters function 80
set-vertical-scroll-parameters generic function 878
shape-mode graphics state parameter 210, 808, 1096
shell-pane class 879
shell-pane-command accessor function 879
show-interface function 881
show-pane function 881
:show-value-p initarg 900, 904
simple-layout class 882
simple-network-pane class 882
simple-pane class 69, 883
simple-pane-background accessor function 885
simple-pane-cursor accessor 15
simple-pane-cursor accessor function 885
simple-pane-drag-callback accessor function 885
simple-pane-drop-callback accessor function 885
simple-pane-enabled accessor function 880, 885, 971
simple-pane-font accessor function 885
simple-pane-foreground accessor function 885
simple-pane-handle function 895
simple-pane-horizontal-scroll accessor function 885
simple-pane-scan-callback accessor function 885
simple-pane-vertical-scroll accessor function 885
simple-pane-visible-border accessor function 885
simple-pane-visible-height function 88
simple-pane-visible-height generic function 895
simple-pane-visible-size function 897
simple-pane-visible-size generic function 898
simple-pane-visible-width function 28
simple-pane-visible-width generic function 896
simple-pinboard-layout class 897
simple-print-port function 206, 252, 898
single selection specifying 62
:single-selection interaction style 49, 61, 62, 113, 317
:sinks initarg 672
slider class 29, 900
slider-print-function accessor function 900
slider-show-value-p accessor function 900
slider-start-point accessor function 900
slider-tick-frequency accessor function 900
slot 5
slot-value function 5
:slug-end initarg 804
:slug-start initarg 804
:small-image-height initarg 596
:small-image-width initarg 596
sorted-object class 903
sorted-object-sort-by generic function 904
sorted-object-sorted-by function 905
sort-object-items-by function 903
Sound API 264
:source-interfaces class option 397
Spaces on Mac OS X 42
special slots
container 93, 425
windows-menu 93, 425
standard image symbols
:std-copy 583, 964, 984
:std-cut 583, 964, 984
:std-delete 583, 964, 984
:std-file-new 583, 964, 984
:std-file-open 583, 964, 984
:std-file-save 583, 964, 984
std-find 583, 965, 984
std-help 583, 965, 984
std-paste 583, 964, 984
std-print 583, 965, 984
std-print-pre 583, 965, 984
std-redo 583, 964, 984
std-replace 583, 965, 984
std-undo 583, 964, 984
start initarg 804, 950
start-drawing-with-cached-display function 906
start-gc-monitor function 909
start-point initarg 188, 575
start-y initarg 188, 575
state-image-function initarg 53, 55, 578, 595, 980
state-image-height initarg 428, 579, 596, 981
state-image-width initarg 428, 579, 596, 981
static-layout class 909
static-layout-child-geometry function 911
static-layout-child-position generic function 912
static-layout-child-size generic function 913
status-text-change-callback
initarg 304
std-copy image symbol 583, 984
std-cut image symbol 583, 984
std-delete image symbol 583, 984
std-file-new image symbol 583, 984
std-file-open image symbol 583, 984
std-file-save image symbol 583, 984
std-find image symbol 583, 984
std-help image symbol 583, 984
std-paste image symbol 583, 984
std-print image symbol 583, 984
std-print-pre image symbol 583, 984
std-properties image symbol 583, 984
std-redo image symbol 583, 984
std-replace image symbol 583, 984
std-undo image symbol 583, 984
stipple graphics state parameter 1093
stop-gc-monitor function 914
stop-sound function 915
stream initarg 363
streams 363
stretch-text-p initarg 960
string-drawing-object class 1214
strings
prompting for 155
structure classes
basic-graph-spec 1179
graphics-state 1092
printer-metrics 759
subclasses
finding 18
subclasses, finding 18
:subitem-function initarg 594
:subitem-print-functions initarg 595
switchable-layout class 915
switchable-layout-compose-class child-constraints accessor function 916
switchable-layout-switchable-children generic function 917
switchable-layout-visible-child accessor function 88, 916
symbols
prompting for 161
system clipboard API 265
T
tab-layout class 88, 918
tab-layout-compose-child-constraints accessor function 919
tab-layout-image-function accessor function 919
tab-layout-combine-child-constraints function 922
tab-layout-visible-child function 923
tab-layout-visible-child-function accessor function 919
tabstops 292
:temp new value for :buffer-name initarg 27
test-function initarg 357
text
displaying 20, 27
displaying on screen 20
editing 20, 27
entering 20, 27
text initarg 12, 20, 22, 32, 33, 412, 448,
titled-object-title-font accessor function 955
titled-pane 957
titled-pane-message 957
titled-pane-title 957
titled-pinboard-object class 958
toolbar-state initarg 531
toolbar-title initarg 885
tooltip initarg 963
tooltips 35, 276
top level interface 137
top level window 137
:top-level-function initarg 525
:top-level-hook initarg 530
top-level-interface generic function 972
top-level-interface-display-state function 105
top-level-interface-display-state generic function 972
top-level-interface-external-border accessor function 532
top-level-interface-geometry function 42, 99, 151
top-level-interface-geometry generic function 974
top-level-interface-geometry-key generic function 975
top-level-interface-p generic function 977
top-level-interface-save-geometry-p generic function 978
top-level-interface-transparent accessor function 532
touch input 182
touch-screen 182
touchscreen 182
touchscreen gestures 182
tracking-pinboard-layout class 978
track-pad 182
trackpad 182
trackpad gestures 182
transform graphics state parameter 1092
transform type 1149
transform-area function 1150
transform-distance function 1151
transform-distances function 1151
transform-is-rotated function

title 148, 955
titled-object-title-font accessor function 955
titled-pane 957
titled-pane-message 957
titled-pane-title 957
titled-pinboard-object class 958
:title-font initarg 18, 955
:title-function initarg 645
:title-gap initarg 489, 955
:title-pane class 17, 242, 952
:title-pane-text accessor function 953
:title-position initarg 19, 74, 955
titles
changing 18, 150
changing interactively 18
for elements 18
for interfaces 18, 150
for windows 18, 150
specifying 17, 17–19
specifying directly 18
:to initarg 498
toolbar
customize 34
folding 34
toolbar buttons 34
toolbar class 125, 134, 960
toolbar-button class 35, 963
toolbar-button-dropdown-menu accessor function 964
toolbar-button-dropdown-menu-function accessor function 964
toolbar-button-dropdown-menu-kind accessor function 964
toolbar-button-image accessor function 964
toolbar-button-popup-interface accessor function 964
toolbar-button-selected-image accessor function 964
toolbar-component class 36, 127, 968
toolbar-flat-p accessor function 961
:title-items initarg 125, 531, 962
toolbar-object class 971
toolbar-object-enabled-function accessor function 971
toolbars 34, 285
adding 125
description of 125–135
disabling items in 134, 134
folding on Cocoa 125
grouping items together 127–128, 131–132
:toolbar-states initarg 531
:title-font initarg 885
tooltip initarg 963
tooltips 35, 276
self-contained examples 285
tooltips 36, 130, 960, 969
top level interface 137
top level window 137
:top-level-function initarg 525
:top-level-hook initarg 530
top-level-interface generic function 972
top-level-interface-display-state function 105
top-level-interface-display-state generic function 972
top-level-interface-external-border accessor function 532
top-level-interface-geometry function 42, 99, 151
top-level-interface-geometry generic function 974
top-level-interface-geometry-key generic function 975
top-level-interface-p generic function 977
top-level-interface-save-geometry-p generic function 978
top-level-interface-transparent accessor function 532
touch input 182
touch-screen 182
touchscreen 182
touchscreen gestures 182
tracking-pinboard-layout class 978
track-pad 182
trackpad 182
trackpad gestures 182
transform graphics state parameter 1092
transform type 1149
transform-area function 1150
transform-distance function 1151
transform-distances function 1151
transform-is-rotated function
1152
transform-point function 1152
transform-points function 1153
transform-rect function 1154
:transparency initarg 531
tree-view class 55, 978
tree-view-action-callback-expand-p accessor function 981
tree-view-checkbox-change-callback accessor function 981
tree-view-checkbox-child-function accessor function 981
tree-view-checkbox-status accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-status function 991
tree-view-children-children-function accessor function 981
tree-view-children-child-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981
tree-view-children-function accessor function 981
tree-view-children-children-function accessor function 981

tree-view-update-an-item
generic function 993
tree-view-update-item generic function 993
Truetype fonts 210
:type initarg 827
types
font 1074
font-description 1075
image-locator 520
transform 1149

U
unconvert-color function 225, 1240
undefine-font-alias function 1154
undefine-menu macro 994
underlined letters 13
unhighlight-pinboard-object
function 994
:uniform-size-p initarg 365, 828
uninstall-postscript-printer
function 995
union-rectangle macro 1155
*unit-transform* variable 1155
unit-transform-p function 1156
unless-empty-rect-bind macro 1156
unmap-typeout function 996
unrecord-dependent-object
generic function 806
:unselected-items-filter initarg 427
:unselected-items-title initarg 427
untransform-distance function 1157
untransform-distances function 1158
untransform-point function 1159
untransform-points function 1159
update-all-interface-titles
function 996
:update-commands-callback initarg 305
update-drawing-with-cached-display function 997
update-drawing-with-cached-display-from-points
function 997
update-interface-title generic function 999
update-pinboard-object function
*update-screen-interfaces-hooks* variable 1001
update-screen-interface-titles function 1000
update-toolbar function 1001
:url initarg 305
:use-images initarg 578, 981
*use-in-place-completion* variable 169
:use-large-images initarg 595
:use-metafile initarg 1211
:use-native-input-method initarg 187, 453, 683
user input 153–168
:use-component initarg 672
:use-small-images initarg 595
:use-state-images initarg 579, 595, 981
using callback functions 11
using the CAPI 5–6

V
validate-rectangle generic function 1160
:value-function keyword argument 165
values
promising for 155–161
variables
*color-database* 1220
*default-editor-pane-line-wrap-marker* 383
*default-image-translation-table* 1042, 1110
*default-non-focus-message-timeout* 383
*default-non-focus-message-timeout-extension* 383
*echo-area-cursor-inactive-style* 445
*editor-cursor-active-style* 446
*editor-cursor-color* 446
*editor-cursor-drag-style* 447
*editor-cursor-inactive-style* 447
*editor-pane-composition-selected-range-faceplist* 459
*editor-pane-default-composition-face* 461
*maximum-moving-objects-to-track-edges* 630
*ppd-directory* 750
*printer-search-path* 762
*unit-transform* 1155
*update-screen-interfaces-hooks* 1001
*use-in-place-completion* 169
:vertical-adjustment initarg 489
:vertical-gap initarg 489
:vertical-scroll initarg 12, 29, 74, 199, 841, 884
:view initarg 594, 595
:view-class initarg 353
:view-details image symbol 583, 965, 984
:view-large-icons image symbol 583, 965, 984
:view-list image symbol 583, 965, 984
:view-net-connect image symbol 584, 965, 984
:view-net-disconnect image symbol 584, 965, 984
:view-new-folder image symbol 584, 965, 984
:view-parent-folder image symbol 584, 965, 984
:view-small-icons image symbol 583, 965, 984
:view-sort-date image symbol 583, 965, 984
:view-sort-name image symbol 583, 965, 984
:view-sort-size image symbol 583, 965, 984
:view-sort-type image symbol 583, 965, 984
virtual-screen-geometry function 42, 152, 1002
visible constraints 81
:visible-border initarg 884
:visible-child initarg 915
:visible-child-function initarg 918, 919
:visible-items-count initarg 677, 924
:visible-max-height initarg 81, 466, 728
:visible-max-width initarg 81, 466, 728
WAV sound files

Windows history image symbols

Windows menus

Windows themes

Works > Refresh menu command

Write-external-image function
X
%x% geometry slot 1012
:x initarg 188, 465, 727
X resources
  fallback resources 269, 272
  in delivered applications 269, 272
X window ID 379, 895
X Window System
display 374
  fallback resources 374
X11
  resources 269, 272
  :x-adjust initarg 77, 1023
  :x-gap initarg 512, 882
  :x-ratios initarg 74, 512
  :x-uniform-size-p initarg 512
x-y-adjustable-layout class 1023

Y
%y% geometry slot 1012
:y initarg 188, 465, 727
:y-adjust initarg 77, 1023
:y-gap initarg 512
:y-ratios initarg 74, 512
:y-uniform-size-p initarg 512

Z
Z-order
  of interfaces 356
  of pinboard-objects 722