COM/Automation
User Guide and
Reference Manual
Version 7.0
# Contents

**Preface** vii

1 Using COM 1

- Prerequisites 1
- Including COM in a Lisp application 1
- The mapping from COM names to Lisp symbols 3
- Obtaining the first COM interface pointer 3
- Reference counting 4
- Querying for other COM interface pointers 4
- Calling COM interface methods 4
- Implementing COM interfaces in Lisp 13
- Calling COM object methods from Lisp 24

2 COM Reference Entries 27

- add-ref 27
- automation-server-command-line-action 28
- automation-server-main 29
- automation-server-top-loop 32
- call-com-interface 33
- call-com-object 35
- check-hresult 36
- co-create-guid 37
- co-initialize 38
- co-task-mem-alloc 38
- co-task-mem-free 40
Contents

coop-uninitialize 40
com-error 41
com-interface 42
com-interface-refguid 42
com-object 43
com-object-destructor 43
com-object-from-pointer 44
com-object-initialize 45
com-object-query-interface 46
create-instance 47
define-com-implementation 48
define-com-method 51
find-clsid 53
get-object 54
guid-equal 55
guid-to-string 56
hresult 56
hresult-equal 57
i-unknown 57
interface-ref 58
make-factory-entry 59
make-guid-from-string 60
midl 61
midl-default-import-paths 64
midl-set-import-paths 65
:midl-file 65
query-interface 66
query-object-interface 67
refguid 68
refguid-interface-name 69
refiid 69
register-class-factory-entry 70
register-server 71
release 72
s_ok 73
server-can-exit-p 74
server-in-use-p 74
set-automation-server-exit-delay 75
set-register-server-error-reporter 75
standard-i-unknown 77
interface-disconnect 130
lisp-variant 131
invoke-dispatch-get-property 131
invoke-dispatch-method 133
invoke-dispatch-put-property 134
make-lisp-variant 136
:midl-type-library-file 136
print-i-dispatch-methods 138
query-simple-i-dispatch-interface 140
register-active-object 141
revoke-active-object 142
set-error-info 142
set-i-dispatch-event-handler 143
set-variant 146
simple-i-dispatch 148
simple-i-dispatch-callback-object 150
standard-automation-collection 151
standard-i-connection-point-container 154
standard-i-dispatch 155
with-coclass 156
with-dispatch-interface 157

5 Tools 161
The COM Implementation Browser 161
The COM Object Browser 165
The COM Interface Browser 166
Editor extensions 167

6 Self-contained examples 169
Argument passing 169
Aggregation 170
OLE embedding of external components 170
Building an ActiveX control 170
OLE automation 171

Index 173
Preface

This manual documents the LispWorks COM/Automation API, which provides a toolkit for using Microsoft COM and Automation with Common Lisp.

For details of using OLE and ActiveX controls with the CAPI, see the class `capi:ole-control-pane` in the CAPI User Guide and Reference Manual.

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

Assumptions

The manual assumes that you are familiar with:

- LispWorks.
- The LispWorks FLI.
- Common Lisp and CLOS, the Common Lisp Object System.
- The functionality of Microsoft COM/Automation.

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

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

Text which refers to Lisp forms is printed like this. Variables and values described in the reference sections are printed like this.

Entries in the reference sections are listed alphabetically and 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”, “Signature”, “Method signature”, “Superclasses”, “Subclasses”, “Slots”, “Accessors”, “Readers”, “Compatibility note”, “Description”, “Notes”, “Examples”, and “See also”.

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

The “Signature” section provides details of the arguments taken by the functions and macros and values returned, separated by the => sign. The top level of parentheses is omitted, but parentheses used for destructuring in macros are included explicitly. Optional items in the syntax of macros are denoted using square brackets [like this]. Repeated items have an asterisk suffix like this*.

For classes, only direct sub- and superclasses are detailed in the “Subclasses” and “Superclasses” sections of each entry.

Examples show fragments of code and sometimes the results of evaluating them.

Finally, the “See also” section provides a reference to other related symbols.

Please let us know if you find any mistakes in the LispWorks documentation, or if you have any suggestions for improvements.

Example files

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

```
(example-edit-file "com/automation/events/ie-events")
```
These examples are files in your LispWorks installation under \texttt{lib/7-0-0-0/examples/}. You can simply evaluate the given form to view the example file.

\textbf{A Description of the Contents}

The manual is divided into four sections, relating to COM, Automation, graphical tools and example files respectively. The COM and Automation sections each contain a user guide and a reference chapter.

Chapter 1, \textit{Using COM} introduces the principles behind the LispWorks COM API and describes how to use it to call COM methods and implement COM servers.

Chapter 2, \textit{COM Reference Entries} provides a detailed description of every function, macro, variable and type in the LispWorks COM API.

Chapter 3, \textit{Using Automation} introduces the LispWorks Automation API and describes how to use it to call Automation methods and implement Automation servers.

Chapter 4, \textit{Automation Reference Entries} provides a detailed description of every function, macro, variable and type in the LispWorks Automation API.

Chapter 5, \textit{Tools} describes some tools which are available in the LispWorks IDE to help with debugging applications using COM/Automation. Please note that your windows may look different from the illustrations shown. This is because some details are controlled by the theme and version of Microsoft Windows, not by LispWorks itself.

Chapter 6, \textit{Self-contained examples} lists the example files which are relevant to the content of this manual and are available in the LispWorks library.
1

Using COM

1.1 Prerequisites

Because COM is a low level binary API, many features of the LispWorks COM API depend on the LispWorks FLI. See the LispWorks Foreign Language Interface User Guide and Reference Manual for details. You should also have a working knowledge of Microsoft COM.

To compile IDL files, you will need Microsoft® Visual C++® installed.

1.2 Including COM in a Lisp application

This section describes how to load COM and generate any FLI definitions needed to use it, and how to build a COM DLL.

1.2.1 Loading the modules

Before using any of the LispWorks COM API, it must be loaded by evaluating

   (require "com")

1.2.2 Generating FLI definitions from COM definitions

COM definitions are typically described in one of two ways, either as IDL files, which allow the full range of COM definitions or as type libraries, which
are generally only used for Automation. Before you can use any COM functionality in a Lisp application, you need to convert the COM definitions into Lisp FLI definitions and various supporting data structures. This corresponds to using `midl.exe` or the MFC Class Wizard when writing C/C++ COM code.

To convert an IDL file, either compile it using the function `midl` or add it to a system definition with the option `:type :midl-file` and compile and load the system.

**Note:** types like `IDispatch` must be declared before they are used, for this conversion to work.

Conversion of type libraries is covered in Chapter 3, “Using Automation”.

### 1.2.3 Standard IDL files

Certain standard IDL files have already been converted to FLI definitions as part of the COM API modules. These are listed below and should not be converted again.

<table>
<thead>
<tr>
<th>IDL file</th>
<th>Part of Lisp module</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNKNWN.IDL</td>
<td>com</td>
</tr>
<tr>
<td>WTYPES.IDL</td>
<td>com</td>
</tr>
<tr>
<td>OAIDL.IDL</td>
<td>automation</td>
</tr>
<tr>
<td>OLEAUTO.IDL</td>
<td>automation</td>
</tr>
<tr>
<td>OCIDL.IDL</td>
<td>automation</td>
</tr>
</tbody>
</table>

### 1.2.4 Making a COM DLL with LispWorks

You can make a DLL with LispWorks by using `deliver` (or `save-image`) with the `:dll-exports` keyword. The value of the `:dll-exports` keyword can include the keyword `:com`, which exports (with appropriate definitions) the standard four symbols that a COM DLL needs:

- `DllGetClassObject`
- `DllRegisterServer`
- `DllUnregisterServer`
- `DllCanUnloadNow`
1.3 The mapping from COM names to Lisp symbols

If no other symbols are exported, the value of :dll-exports can be the keyword :com, which means the same as the list (:com). See the LispWorks Delivery User Guide for more details.

You can use the function set-register-server-error-reporter to report when calls to DllRegisterServer or DllUnregisterServer fail.

1.3 The mapping from COM names to Lisp symbols

COM names are typically a mixture of upper and lower case letters and digits, with words capitalized. These names are mapped to Lisp symbols, adding hyphens to match typical Lisp conventions for word boundaries. These examples illustrate some conversions:

<table>
<thead>
<tr>
<th>COM name</th>
<th>Lisp name</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUnknown</td>
<td>i-unknown</td>
</tr>
<tr>
<td>pStr</td>
<td>p-str</td>
</tr>
<tr>
<td>DWORD</td>
<td>dword</td>
</tr>
<tr>
<td>IEnumVARIANT</td>
<td>i-enum-variant</td>
</tr>
</tbody>
</table>

In addition, COM methods with the propget attribute have a get- prefix added to their names and COM methods with the propput or propputref attributes have a put- prefix added to their names. Note that these prefixes are not used when calling methods via Automation.

To see the mapping for a particular file, look at the output while loading a converted IDL file or type library.

1.4 Obtaining the first COM interface pointer

All interaction with a remote COM server is done via its interface pointers and the most common way to obtain the first interface pointer is using the function create-instance. This takes the CLSID of the server and returns an interface pointer for the i-unknown interface unless another interface name is specified.

For example, the following will create an instance of Microsoft Word:

```
(create-instance "000209FF-0000-0000-C000-000000000046")
```
1.5 Reference counting

The lifetime of each COM interface pointer is controlled by its reference count. When a new reference to a COM interface pointer is made, the function `add-ref` should be called to increment its reference count. When a reference is removed, the function `release` should be called to decrement it again. The macro `with-temp-interface` can be useful when working with temporary interface pointers to ensure that they are released when a body of code exits in any way.

Refer to standard COM texts for more details of the reference counting rules. The LispWorks COM API does not perform any automatic reference counting (sometimes called `smart pointers` in C++).

1.6 Querying for other COM interface pointers

An interface pointer can be queried to discover if the underlying object supports other interfaces. This is done using the function `query-interface`, passing the interface pointer and the `refiid` of the interface to query. A `refiid` is either a foreign pointer to a GUID structure or a symbol naming a COM interface as described in Section 1.3.

For example, the function below will find the COM interface pointer for its `i-dispatch` interface:

```lisp
(defun find-dispatch-pointer (ptr)
  (query-interface ptr 'i-dispatch))
```

The macro `with-query-interface` can be used to query an interface pointer and automatically release it again on exit from a body of code.

1.7 Calling COM interface methods

The macros `call-com-interface` and `with-com-interface` are used to call COM methods. To call a COM method, you need to specify the interface name, the method name, a COM interface pointer and suitable arguments. The interface and method names are given as symbols named as in Section 1.3 and the COM interface pointer is a foreign pointer of type `com-interface`. In both macros, the `args` and `values` are as specified in the Section 1.7.1.
The `with-com-interface` macro is useful when several methods are being called with the same COM interface pointer, because it establishes a local macro that takes just the method name and arguments.

For example, the following are equivalent ways of calling the `move` and `resize` methods of a COM interface pointer `window-ptr` for the `i-window` interface:

```lisp
(progn
  (call-com-interface (window-ptr i-window move) 10 10)
  (call-com-interface (window-ptr i-window resize) 100 100))

(with-com-interface (call-window-ptr i-window) window-ptr
  (call-window-ptr move 10 10)
  (call-window-ptr resize 100 100))
```

### 1.7.1 Data conversion when calling COM methods

All IDL definitions map onto FLI definitions, mirroring the mapping that `midl.exe` does for C/C++. However, IDL provides some additional type information that C/C++ lacks (for instance the `string` attribute), so there are some additional conversions that Lisp performs when it can.

The COM API uses the information from the IDL to convert data between FLI types and Lisp types where appropriate for arguments and return values of COM method calls. In particular:

- Primitive integer types are represented as Lisp integers.
- Primitive char types are represented as Lisp characters.
- Primitive float types are represented as Lisp float types.
- COM interface pointers are FLI objects represented as objects of type `com-interface`, which supports type checking of the interface name.
- Except as detailed below, all other COM types are represented as their equivalent FLI types. This includes other pointer types and structs.

In COM, all parameters have a direction which can be either `in`, `out` or both `in` and `out` (referred to as `in-out` here). Arguments and values for client-side COM method calls reflect the direction as described in the following sections. For a complete version of the example code, see the file:

```lisp
(example-edit-file "com/manual/args/args-calling")
```
1.7.1.1 In parameters

In parameters are passed as positional arguments in the order they are specified and do not affect the return values.

- A parameter with the string attribute can be passed either as a foreign pointer or as a Lisp string (converted to a foreign string with dynamic extent for the duration of the call).
- A parameter whose type is either an array type or a pointer type with a size_is attribute can be passed either as a foreign pointer or, if the element type is not a foreign aggregate type, as a Lisp array of the appropriate rank (converted to a foreign array with dynamic extent for the duration of the call).
- Otherwise, the Lisp value is converted using the FLI according to the mapping of types defined above.

For example, given the IDL

```idl
import "unknwn.idl";

[ object,
  uuid(E37A70A0-EFC9-11D5-BF02-000347024BE1)
 ]
interface IArgumentExamples : IUnknown
{
  typedef [string] char *argString;

  HRESULT inMethod([in] int inInt,
                   [in] argString inString,
                   [in] int inArraySize,
                   [in, size_is(inArraySize)] int *inArray);
}
```

the method in-method can be called with Lisp objects like this:

```lisp
(let ((array #(7 6)))
  (call-com-interface (arg-example i-argument-examples
                       in-method)
                       42
                       "the answer"
                       (length array)
                       array))
```

or with foreign pointers like this:
1.7 Calling COM interface methods

(fli:with-dynamic-foreign-objects ()
  (let* ((farray-size 2)
         (farray (fli:allocate-dynamic-foreign-object
                  :type :int
                  :nelems farray-size
                  :initial-contents '(7 6)))
         (farray-size farray-size))
         (fli:with-foreign-string (fstring elt-count byte-count)
             "the answer"
             (declare (ignore elt-count byte-count))
             (call-com-interface (arg-example i-argument-examples
                                        in-method)
                                 42
                                 fstring
                                 farray-size
                                 farray))))

Note that the int arguments are always passed as Lisp integer because int is a primitive type.

1.7.1.2 Out parameters

Out parameters are always of type pointer in COM and never appear as positional arguments in the Lisp call. Instead, there is a keyword argument named after the parameter, which can be used to pass an object to be modified by the method. In addition, each out parameter generates a return value, which will be eq to the value of keyword argument if it was passed and otherwise depends on the type of the parameter as described below.

- If the value of the keyword argument is a foreign pointer then it is passed directly to the method and is expected to point to an object of the appropriate size to contain the returned data.
- If the value of the keyword argument is nil then a null pointer is passed to the method.
- Except where specified below, if the keyword argument is omitted, a foreign object with dynamic extent is created to contain the value and a pointer to this object is passed to the method. On return, the contents maybe be converted back to a Lisp object as specified.
- A parameter with the string attribute is converted to a Lisp string if the keyword is not passed. If the keyword is passed, the memory for the
string might need to be freed by `co-task-mem-free` if nothing else does this.

- A parameter whose type is either an array type or a pointer type with a `size_is` attribute will be converted to a Lisp array if the keyword is not passed and the element type is not a foreign aggregate type. If the keyword argument is not passed then a new Lisp array is made. If the value of the keyword argument is a Lisp array then that is filled.

- For a parameter whose type is a foreign aggregate type, such as `struct`, the keyword argument must be passed and its value must be as a foreign pointer. This pointer is passed directly to the method.

- For a parameter with the `iid_is` attribute, a `com-interface` pointer is returned using the indicated iid parameter to control the interface name.

- Otherwise, the dynamic extent foreign pointer is dereferenced to obtain the Lisp return value, as if by calling `fli:dereference`.

For example, given the IDL

```idl
import "unknwn.idl";

[ object,
  uuid(E37A70A0-EFC9-11D5-BF02-000347024BE1)
] interface IArgumentExamples : IUnknown
{
  typedef [string] char *argString;

  HRESULT outMethod([out] int *outInt,
  [out] argString *outString,
  [in] int outArraySize,
  [out, size_is(outArraySize)] int *outArray);
}
```

the method `out-method` can return Lisp objects like this:
1.7 Calling COM interface methods

(multiple-value-bind (hres int string array)
  (call-com-interface (arg-example i-argument-examples
                      out-method)
    ;; int is of type integer
    ;; string is of type string
    ;; array is of type array )
)
or fill an existing array like this:

(let ((out-array (make-array 5)))
  (multiple-value-bind (hres int string array)
    (call-com-interface (arg-example i-argument-examples
                         out-method)
      (length out-array)
      :out-array out-array)
    ;; int is of type integer
    ;; string is of type string
    ;; array is eq to out-array and was filled )
)
or set the contents of foreign memory like this:

(fli:with-dynamic-foreign-objects ((out-int :int)
                                   (out-string WIN32:LPSTR))
  (let* ((out-farray-size 5)
    (out-farray (fli:allocate-dynamic-foreign-object
                :type :int
                :nelems out-farray-size)))
    (multiple-value-bind (hres int string array)
      (call-com-interface (arg-example i-argument-examples
                           out-method)
        out-farray-size
        :out-int out-int
        :out-string out-string
        :out-array out-farray)
      ;; Each foreign pointer contains the method’s results
      ;; int is the foreign pointer out-int
      ;; string is the foreign pointer out-string
      ;; array is the foreign pointer out-array
      ;; Note that the string must be freed as follows:
      (co-task-mem-free (fli:dereference out-string)))))}
1.7.1.3 In-out parameters

In-out parameters are always of type pointer in COM and are handled as a mixture of in and out. In particular, they have both a positional parameter and a keyword parameter, which can be used to control the value passed and conversion of the value returned respectively. Each in-out parameter generates a return value, which will be eq to the value of the keyword argument if it was passed and otherwise depends on the type of the parameter as below.

- As for out parameters, if the value of the keyword argument is a foreign pointer then it is passed directly to the method and is expected to be of the appropriate size to contain the returned data. If the value of the keyword argument is nil then a null pointer is passed to the COM call. The positional argument should be nil in these cases. If the keyword argument not passed, a foreign object with dynamic extent is created to contain the value, initialized with data from the positional argument before calling the method and possibly converted back to a Lisp value on return.

- For a parameter with the string attribute, the positional argument is handled as for the in argument string case and the keyword argument is handled as for the out argument string case. The functions co-task-mem-alloc and co-task-mem-free should be used to manage the memory for the string itself.

- For a parameter whose type is a non-aggregate array type or a pointer to a non-aggregate type that has the size_is attribute, the positional argument is handled as for the in argument array case and the keyword argument is handled as for the out argument array case. To update an existing array, pass it as both the positional and keyword argument values.

- For a parameter whose type is a foreign aggregate type, the keyword argument must be passed and its value must be a foreign pointer. This pointer is passed directly to the method and the positional argument should be nil.

- Otherwise, a foreign object with dynamic extent is created, set to contain the value of positional argument before calling the method and
dereferenced on return to obtain the Lisp return value, as if by calling `fli:dereference`.

For example, given the IDL

```idl
import "unknwn.idl";

[ object,
  uuid(E37A70A0-EFC9-11D5-BF02-000347024BE1)
] interface IArgumentExamples : IUnknown
{
  typedef [string] char *argString;

  HRESULT inoutMethod(
    [in, out] int *inoutInt,
    [in, out] argString *inoutString,
    [in] int inoutArraySize,
    [in, out, size_is(inoutArraySize)] int *inoutArray);
}
```

the method `inout-method` can receive and return Lisp objects like this:

```lisp
(let ((in-array #(7 6)))
  (multiple-value-bind (hres int string array)
      (call-com-interface (arg-example i-argument-examples
        inout-method)
        42
        "the answer"
        (length in-array)
        in-array)
    ;; int is of type integer
    ;; string is of type string
    ;; array is of type array)
)
```

or fill an existing array like this:

```lisp
(let ((in-array #(7 6)))
  (multiple-value-bind (hres int string array)
      (call-com-interface (arg-example i-argument-examples
        inout-method)
        42
        "the answer"
        (length in-array)
        in-array)
    ;; int is of type integer
    ;; string is of type string
    ;; array is of type array)
)
```
1 Using COM

```lisp
(let* ((in-array #(7 6))
       (out-array (make-array (length in-array))))
  (multiple-value-bind (hres int string array)
      (call-com-interface (arg-example i-argument-examples
                           inout-method)
                           42
                           "the answer"
                           (length in-array)
                           in-array
                           :inout-array out-array)
    ;; int is of type integer
    ;; string is of type string
    ;; array is eq to out-array, which was filled
    ))

or update an existing array like this:

```lisp
(let* ((inout-array #(7 6))
       (multiple-value-bind (hres int string array)
      (call-com-interface (arg-example i-argument-examples
                           inout-method)
                           42
                           "the answer"
                           (length inout-array)
                           inout-array
                           :inout-array inout-array)
    ;; int is of type integer
    ;; string is of type string
    ;; array is eq to inout-array, which was updated
    ))

1.7.2 Error handling

Most COM methods return an integer hresult to indicate success or failure, which can be checked using succeeded, s_ok, hresult-equal or check-hresult.

In addition, after calling a COM method that provides extended error information, you can call the function get-error-info to obtain more details of any error that occurred. This is supplied with a list of fields, which should be keywords specifying the parts of the error information to obtain.

For example, in the session below, tt is a COM interface pointer for the i-test-suite-1 interface:
1.8 Implementing COM interfaces in Lisp

Lisp implementations of COM interfaces are created by defining an appropriate class and then defining COM methods for all the interfaces implemented by this class.

The class can inherit from standard-i-unknown to obtain an implementation of the i-unknown interface. This superclass provides reference counting and an implementation of the query-interface method that generates COM interface pointers for the interfaces specified in the class definition. It also supports aggregation.

There are two important things to note about COM classes and methods:

- The implementation objects and COM interface pointers are different things: an interface pointer must be queried from the implementation object explicitly and the function com-object-from-pointer can be used to obtain an object from an interface pointer. This is show in Figure 1.1 below.

- COM methods are not defined with defmethod because they have very specific conventions for passing arguments and returning values that are different from those of Lisp.
1.8.1 Steps required to implement COM interfaces

To implement a COM interface in Lisp, you need the following:

1. Some COM interface definitions, converted to Lisp as specified in Section 1.2.2
2. A COM object class defined with the macro `define-com-implementation`, specifying the interface(s) to implement.
4. If the objects are to be created by another process, a description of the class factories created with `make-factory-entry` and registered with `register-class-factory-entry`.
5. Initialization code to call `co-initialize`. It should also call `start-factories` in a thread that will be processing Windows messages (for instance a CAPI thread) if you have registered class factories.

1.8.2 The lifecycle of a COM object

Since COM objects can be accessed from outside the Lisp world, possibly from a different application, their lifetimes are controlled more carefully than those...
of normal Lisp objects. The diagram below shows the lifecycle of a typical COM object.

![Diagram](image.png)

Figure 1.2 The lifecycle of a COM object

Each COM object goes through the following stages.

1. **CLOS object initialization.**
   
   In the first stage, the object is created by a call to `make-instance`, either by a class factory (see Section 1.8.3) or explicitly by the application. The normal CLOS initialization mechanisms such as `initialize-instance` can be used to initialize the object. During this stage, the object is known only to Lisp and can be garbage collected if the next stage is not reached.

2. **COM initialization.**
   
   At some point, the server makes the first COM interface pointer for the object by invoking the COM method `query-interface`, either automatically in the class factory or explicitly using by using macros such as `query-object-interface` or `call-com-object`. When this happens, the object’s reference count will become 1 and the object will be stored in
the COM runtime system. In addition, the generic function `com-object-initialize` is called to allow class-specific COM initialization to be done.

3. **COM usage.**
   In this stage, the object is used via its COM interface pointers by a client or directly by Lisp code in the server. Several COM interface pointers might be created and each one contributes to the overall reference count of the object.

4. **COM destruction.**
   This stage is entered when the reference count is decremented to zero, which is triggered by all the COM interface pointers being released by their clients. The generic function `com-object-destructor` is called to allow class-specific COM cleanups and the object is removed from the COM runtime system. From now on, the object is not known to COM world.

5. **Garbage collection.**
   The final stage of an object’s lifecycle is the normal Lisp garbage collection process, which removes the object from memory when there are no more references to it.

1.8.3 **Class factories**

The LispWorks COM runtime provides an implementation of the *class factory* protocol, which will construct COM objects on demand. The class factory implementation supports *aggregation* when passed an outer unknown pointer.

Class factories are described by objects created with `make-factory-entry` and must be registered with the COM runtime using `register-class-factory-entry`. The function `start-factories` should be called when the application initializes to start all the registered class factories.

When using the Automation API described in Chapter 3 and Chapter 4, class factories are created and registered automatically by the `define-automation-component` macro if appropriate.
1.8.4 Unimplemented methods

If the class does not define all the COM methods for the interfaces it imple-
ments, then some of those methods may be inherited from superclasses (see
Section 1.8.5). If there is no direct or inherited definition of a method, then a
default method that returns E_NOTIMPL will be provided automatically. The
default method also fills all out arguments with null bytes and ignores all in
and in-out arguments except those needed to compute the size of arrays for
filling out arguments.

1.8.5 Inheritance

A COM object class will inherit COM method implementations from its super-
classes if no direct method is defined. However, unlike Lisp methods where
an effective method is computed from the set of applicable methods for each
generic function, COM methods are always inherited in groups via their
defining interface. This is because the interface is used to call a COM method,
not the COM object

Specifically, each method is inherited from the first class in the class prece-
dence list that implements the interface where the method is declared. No
attempt is made to search further down the class precedence list if this class is
using the unimplemented method definition described in Section 1.8.4.

1.8.5.1 An example of multiple inheritance

The inheritance rules may lead to unexpected results in the case of multiple
inheritance. For example, consider the following IDL:

```idl
// IDL definition of IFoo
import "unknwn.idl";

[ uuid(7D9EB760-E4E5-11D5-BF02-000347024BE1) ]
interface IFoo : IUnknown
{
    HRESULT meth1();
    HRESULT meth2();
    HRESULT meth3();
}
```

and these three (partial) implementations of the interface i-foo.
1. An implementation with no definition of `meth2`:

```scheme
(define-com-implementation foo-impl-1 ()
  ()
  (:interfaces i-foo))

(define-com-method meth1 ((this foo-impl-1))
  s_ok)

(define-com-method meth3 ((this foo-impl-1))
  s_ok)
```

2. An implementation with no definition except `meth2`:

```scheme
(define-com-implementation foo-impl-2 ()
  ()
  (:interfaces i-foo))

(define-com-method meth2 ((this foo-impl-2))
  s_ok)
```

3. A combined implementation, inheriting from steps 1 and 2.

```scheme
(define-com-implementation foo-impl-12 (foo-impl-1 foo-impl-2)
  ()
  (:interfaces i-foo))
```

In step 3, the class `foo-impl-12` implements the interface `i-foo`, but inherits all the `i-foo` method definitions from `foo-impl-1`, which is the first class in the class precedence list that implements that interface. These method definitions include the "unimplemented" definition of `meth2` in `foo-impl-1`, which hides the definition in the other superclass `foo-impl-2`. As a result, when the following form is evaluated with `p-foo` created from an instance of `foo-impl-12`:

```scheme
(let ((object (make-instance 'foo-impl-12)))
  (with-temp-interface (p-foo)
    (nth-value 1 (query-object-interface foo-impl-12 object 'i-foo))
    (with-com-interface (call-p-foo i-foo) p-foo
      (values (call-p-foo meth1)
              (call-p-foo meth2)
              (call-p-foo meth3)))))
```
1.8 Implementing COM interfaces in Lisp

the three values are S_OK, E_NOTIMPL and S_OK.

1.8.5.2 A second example of multiple inheritance

Here is a further extension to the example in Section 1.8.5.1, with an additional interface i-foo-ex that inherits from i-foo as in the following IDL:

```idl
[ uuid(7D9EB761-E4E5-11D5-BF02-000347024BE1) ]
interface IFooEx : IFoo
{
HRESULT meth4();
}
```

This interface has the following additional implementations:

1. An implementation defining all the methods in i-foo-ex:

```lisp
(define-com-implementation foo-ex-impl-1 ()
()
(:interfaces i-foo-ex))

(define-com-method meth1 ((this foo-ex-impl-1))
s_ok)

(define-com-method meth2 ((this foo-ex-impl-1))
s_ok)

(define-com-method meth3 ((this foo-ex-impl-1))
s_ok)

(define-com-method meth4 ((this foo-ex-impl-1))
s_ok)
```

2. A combined implementation, inheriting from step 3 from Section 1.8.5.1 and step 1 above.

```lisp
(define-com-implementation foo-ex-impl-2 (foo-impl-12
foo-ex-impl-1)
()
(:interfaces i-foo-ex))
```

In step 2, the class foo-ex-impl-2 implements the interface i-foo-ex and is a subclass of foo-ex-impl-1, which implements i-foo. When the following form is evaluated with p-foo-ex created from an instance of foo-ex-impl-2:
(let ((object (make-instance 'foo-ex-impl-2)))
  (with-temp-interface (p-foo-ex)
    (nth-value 1 (query-object-interface foo-ex-impl-2 object 'i-foo-ex))
    (with-com-interface (call-p-foo i-foo-ex) p-foo-ex
      (values (call-p-foo meth1)
              (call-p-foo meth2)
              (call-p-foo meth3)
              (call-p-foo meth4))))

the four values are S_OK, E_NOTIMPL, S_OK and S_OK.

Note that, even though foo-ex-impl-2 only explicitly implements i-foo-ex, the methods meth1, meth2 and meth3 were declared in its parent interface i-foo. This means that their definitions (including the "unimplemented" definition of meth2) are inherited from foo-impl (via foo-impl-12), because foo-impl-12 is before foo-ex-impl-2 in the class precedence list of foo-ex-impl-2. Only meth4, which is declared in i-foo-ex, is inherited from foo-ex-impl-1.

### 1.8.6 Data conversion in define-com-method

All IDL definitions map onto FLI definitions, mirroring the mapping that midl.exe does for C/C++. However, IDL provides some additional type information that C/C++ lacks (for instance the string attribute), so there are some additional conversions that Lisp performs when it can. For a complete example of data conversion, see the file:

```
(example-edit-file "com/manual/args/args-impl")
```

### 1.8.6.1 FLI types

The COM API uses the information from the IDL to convert data between FLI types and Lisp types where appropriate for arguments and return values of COM method definitions. In particular:

- Primitive integer types are represented as Lisp integers
- Primitive char types are represented as Lisp characters.
- Primitive float types are represented as Lisp float types.
1.8 Implementing COM interfaces in Lisp

- COM interface pointers are represented as objects of type `com-interface`, which supports type checking of the interface name.
- All other types are represented as their equivalent FLI types. This includes other pointer types and structs.

Each argument is the IDL has a corresponding argument in the `define-com-method` form. In addition, each argument has a `pass-style` which specifies whether additional conversions are performed.

If the `pass-style` of a parameter is `:foreign`, then the value will be exactly what the FLI would provide, i.e. foreign pointers for strings and for all `out` or `in-out` parameters (which are always pointers in the IDL).

If the `pass-style` of a parameter is `:lisp`, then the conversions described in the following sections will be done.

1.8.6.2 In parameters

For `in` parameters:

- A parameter with the `string` attribute will be converted to a Lisp string. The string should not be destructively modified by the body.
- A parameter of COM type `BSTR` will be converted to a Lisp string. The string should not be destructively modified by the body.
- A parameter of COM type `VARIANT*` will be converted to a Lisp object according to the VT code in the variant (see Table 3.1, page 93).
- A parameter of COM type `SAFEARRAY(type)` or `SAFEARRAY(type) *` will be converted to a Lisp array. The elements of type `type` are converted as in Table 3.1.
- A parameter of COM type `VARIANT_BOOL` will be converted to `nil` (for zero) or `t` (for any other value). Note that a parameter of type `BOOL` will be converted to an `integer` because type libraries provide no way to distinguish this case from the primitive integer type.
- A parameter whose type is an array type or a pointer type with a `size_is` attribute will be converted to a temporary Lisp array. The Lisp array might have dynamic extent.
• Otherwise, the value is converted to a Lisp value using the FLI according to the mapping of types defined in Section 1.8.6.1.

1.8.6.3 Out parameters

For out parameters:

• A parameter whose type is an array type or a pointer type with a size_is attribute will be converted to a Lisp array of the appropriate size allocated for the dynamic extent of the body forms. After the body has been evaluated, the contents of the array will be copied into the foreign array that the caller has supplied.

• For other types, the parameter will be nil initially and the body should use setq to set it to the value to be returned.

In the latter case, the value will be converted to a foreign object after the body has been evaluated. The following conversions are done:

• For a parameter with the string attribute, a Lisp string will be converted to a foreign string using CoTaskMemAlloc().

• For a parameter of COM type BSTR*, a Lisp string will be converted to a foreign string using SysAllocString().

• For a parameter of COM type VARIANT*, the value can be any Lisp value, with the VT code being set according to the Lisp type (see Table 3.1, page 93). If exact control is required, use the pass-style :foreign and the function set-variant.

• For a parameter of COM type SAFEARRAY (type) *, the value can be either a foreign pointer to an appropriate SAFEARRAY or a Lisp array. In the latter case, a new SAFEARRAY is created which contains the elements of the Lisp array converted as in Table 3.1.

• For a parameter of COM type VARIANT_BOOL*, the value can be a generalized boolean.

• Otherwise, the Lisp value will be converted using the FLI according to the mapping of types defined in Section 1.8.6.1.
1.8.6.4 In-out parameters

For in-out parameters:

- A parameter whose type is an array type or a pointer type with a `size_is` attribute will be converted to a Lisp array of the appropriate size allocated for the dynamic extent of the body forms. The initial contents of the Lisp array will be taken from the foreign array which was passed by the caller. After the body has been evaluated, the contents of the Lisp array will be copied back into the foreign array.

- For a parameter with the `string` attribute, the parameter will be converted to a Lisp string. To return a different string, the parameter should be set to another (non `eq`) Lisp string, which will cause the original foreign string to be freed with `CoTaskMemFree()` and a new foreign string allocated with `CoTaskMemAlloc()`. The initial string should not be destructively modified by the body.

- For a parameter of COM type `BSTR*`, the parameter will be converted to a Lisp string. To return a different string, the parameter should be set to another (non `eq`) Lisp string, which will cause the original foreign string to be freed with `SysFreeString()` and a new foreign string allocated with `SysAllocString()`.

- For parameters of COM type `VARIANT*`, the parameter will be converted to a Lisp object (see Table 3.1, page 93). To return a different value, the parameter should be set to another (non `eq`) value, which will be placed back into the `VARIANT` with the VT code being set according to the Lisp type (see Table 3.1, page 93). If exact control of the VT code is required, use the `pass-style :foreign` and the function `set-variant`.

- For parameters of COM type `SAFEARRAY(type)*`, the parameter will be converted to a Lisp array. The elements of type `type` are converted as in Table 3.1. To return a different value, the parameter should be set to another (non `eq`) value, which can be either a foreign pointer to an appropriate `SAFEARRAY` or a Lisp array. In the latter case, a new `SAFEARRAY` is created which contains the elements of the Lisp array converted as in Table 3.1.

- For parameter of COM type `VARIANT_BOOL*`, the parameter will be `nil` or `t` according to the initial value (zero or non zero). To return a differ-
1.9 Calling COM object methods from Lisp

Within the implementation of a COM object, the macros `call-com-object` and `with-com-object` can be used to call COM methods directly for a COM object without using an interface pointer. To call a COM method, you need to specify the class name, the method name, the interface name if the method name is not unique, a COM object and suitable arguments. The class name is a symbol as used in the `define-com-implementation` form and can be a superclass of the actual object class. The method and interface names are given as symbols named as in Section 1.3. and the arguments and values are as specified below in Section 1.9.1. These macros should be used with caution because they assume that the caller knows the implementation's `pass-style` for all the arguments.

The `with-com-object` macro is useful when several methods are being called with the same COM object, because it establishes a local macro that takes just the method name and arguments.

1.9.1 Data conversion when calling COM object methods

No explicit argument or return value conversion is done by `call-com-object` or `with-com-object`. As a result, every argument must be passed as a positional argument and must be of the type expected by the method’s implementation. The allowable types are described in the following sections.

1.9.1.1 In parameters

For `in` parameters,

- For a parameter with the `string` attribute, the value can be a Lisp string.
- For a parameter of COM type `BSTR`, the value can be a Lisp string.
- For a parameter whose type is an array type or a pointer type with a `size_is` attribute, the value can be a Lisp array of the appropriate rank and dimension.
• Otherwise, the value should match what the FLI would generate for the parameter's type.

1.9.1.2 Out parameters
For out parameters,
• If nil is passed, the value from the method is returned without any conversion.
• For a parameter whose type is an array type or a pointer type with a size_is attribute, the value can be a Lisp array. The contents of the array will be modified by the method and the array will be returned as a value.
• Otherwise, the value should be a foreign pointer of the type that the FLI would generate for the parameter's type. The foreign pointer will be returned as a value.

1.9.1.3 In-out parameters
For in-out parameters,
• For a parameter whose type is an array type or a pointer type with a size_is attribute, the value can be a Lisp array. The contents of the array will be modified by the method and the array will be returned as a value.
• For a parameter with the string attribute, the parameter can be a Lisp string. The value of the parameter at the end of the body will be returned as a value.
• For a parameter of COM type BSTR*, the parameter can be a Lisp string. The value of the parameter at the end of the body will be returned as a value.
• For parameters of COM type VARIANT*, the parameter can be any Lisp object. The value of the parameter at the end of the body will be returned as a value.
• If the value is a foreign pointer of the type that the FLI would generate for the parameter's type then the foreign object it points to will be the
value of the parameter. The foreign pointer will be returned as a value, with the new contents as modified (or not) by the method.

- Otherwise, the parameter is passed directly to the method and the value of the parameter at the end of the body will be returned as a value.
This chapter documents COM functionality.

**add-ref**

**Function**

**Summary**
Increments the reference count of a COM interface pointer.

**Package**
com

**Signature**
add-ref interface-ptr => ref-count

**Arguments**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>interface-ptr</td>
<td>A COM interface pointer.</td>
</tr>
</tbody>
</table>

**Values**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref-count</td>
<td>The new reference count.</td>
</tr>
</tbody>
</table>

**Description**
Each COM interface pointer has a reference count which is used by the server to control its lifetime. The function **add-ref** should be called whenever an extra reference to the interface pointer is being made. The function invokes the COM method IUnknown::AddRef so the form

(add-ref ptr)

is equivalent to using call-com-interface as follows:
(call-com-interface (ptr i-unknown add-ref))

Example
(add-ref p-foo)

See also
release
interface-ref
query-interface
call-com-interface

**automation-server-command-line-action**  
*Function*

**Summary**
Reports what action was specified for the automation server.

**Package**
com

**Signature**
automation-server-command-line-action => action

**Arguments**
None.

**Values**
One of the keywords :register, :unregister or :embedding, or nil.

**Description**
The function automation-server-command-line-action inspects the command line to see what action was specified for the automation server. The possible return values have the following meanings:

:register  The server should register itself (by register-server). Specified by /RegServer.

:unregister  The server should unregister itself (by unregister-server). Specified by /UnRegServer.

:embedding  The server was run with /Embedding or -Embedding.

nil  No recognized action.
See also

register-server
unregister-server

**automation-server-main**

*Function*

**Summary**

For use as the main function for an automation server.

**Package**

com

**Signature**

`automation-server-main &key exit-delay exit-function new-process force-server forced-exit-delay quit-on-registry-error handle-registry-error`

**Arguments**

- `exit-delay`: A non-negative real number.
- `exit-function`: A function specifier.
- `new-process`: A boolean.
- `force-server`: A boolean.
- `forced-exit-delay`: A non-negative real number.
- `quit-on-registry-error`: A boolean.
- `handle-registry-error`: A boolean.

**Description**

The function `automation-server-main` is for use as the main function for an automation server.

`exit-delay`, if supplied, sets the exit delay for `automation-server-top-loop`, by calling `set-automation-server-exit-delay` with it.

`exit-function` is an exit-function for `automation-server-top-loop`. The default value of `exit-function` is `server-can-exit-p`. 
new-process controls whether to run automation-server-top-loop in its own process.

force-server controls whether to force running the automation server even if the application starts normally. The default value of force-server is t.

forced-exit-delay specifies the exit-delay in seconds when the server is forced.

automation-server-main checks the command line (using automation-server-command-line-action) for what action it should do, and then does it.

If the action is :register or :unregister, automation-server-main tries register or unregister the server (using register-server and unregister-server). If the operation succeeds, automation-server-main just returns :register or :unregister.

handle-registry-error controls what happens if there is an error while trying to register or unregister. If nil is supplied then error is called, and if a non-nil value is supplied, then the error is handled. If handle-registry-error is not supplied, by default the error is handled, but if the command line contains -debug or /debug, the error is not handled. The default value of handle-registry-error is nil.

quit-on-registry-error controls what happens if an error occurs during registration. If it is non-nil (the default), then automation-server-main calls quit with the appropriate status value (5). Otherwise it returns :register-failed or :unregister-failed. The default value of quit-on-registry-error is t.

If the command line action is :embedding or the action is nil and force-server is non-nil (the default) then automation-server-main runs the server by using automation-server-top-loop. If new-process is nil (the default), automation-server-top-loop is called on the current process. In this case automation-server-main returns only after automa-
tion-server-top-loop exits (and the server was closed). If new-process is true, automation-server-top-loop is called on its own process and automation-server-main returns immediately.

If the server is "forced", that is the action is nil but force-server is non-nil, and forced-exit-delay is non-nil, the exit-delay is set to forced-exit-delay (using set-automation-server-exit-delay). This overrides the value of the argument exit-delay.

automation-server-main returns the result of automation-server-command-line-action, except in the case of registry failure as described above.

Notes

1. automation-server-main is intended to be used as the main function in an automation server that is delivered as an executable (rather than as a DLL).

2. When the application acts only as automation server, automation-server-main can be the function argument to deliver, or the restart-function in save-image (multiprocessing t is needed too). It will deal correctly with registration when the command line argument is supplied, otherwise runs the server until it can exit and then returns (the application will exit because there will not be any other processes).

3. When the application also needs to do other things, automation-server-main can be used to run the server. Note that with the default values when automation-server-main runs the server it does not return until the server exits, so you need to either pass :new-process t, or run it on its own process. You will also need to consider whether to wait when failing to register, and hence may want to pass :quit-on-registry-failure nil.

See also

automation-server-top-loop
automation-server-command-line-action
set-automation-server-exit-delay
**automation-server-top-loop**

**Function**

**Summary**
A function to run a COM server.

**Package**
com

**Signature**
`automation-server-top-loop &key exit-delay exit-function`

**Arguments**

- **exit-function**
  A function designator.

- **exit-delay**
  A non-negative real number specifying a time in seconds.

**Description**
The function `automation-server-top-loop` calls `co-initialize` and `start-factories`, and then processes messages, until the server can exit. Since COM works by messages, it will end up processing all COM requests.

`exit-function` determines when the server can exit. It defaults to `server-can-exit-p`, which is normally the right function. This returns `t` when the COM server is not used and there are no other "working processes". See the documentation for `server-can-exit-p`. When `exit-function` is supplied, it needs to be a function of no arguments which returns true when the server can exit. The `exit-function` is used like a wait function: it is called repeatedly, it needs to be reasonably fast, and should not wait for anything.

Once the server can exit, `automation-server-top-loop` delays exiting for another period of time, `exit-delay` seconds. `exit-delay` defaults to 5, and can be set by calling `set-automation-server-exit-delay`. If supplied, `exit-delay` is passed to `set-automation-server-exit-delay` on entry. However, later calls to `set-automation-server-exit-delay` can change the `exit-delay`.

After the delay `automation-server-top-loop` checks again by calling `exit-function`. If this returns false it goes on to process messages. Otherwise it stops the factories, calls `co-uninitialize` and returns.
Notes

1. **automation-server-top-loop** interacts with the `deliver` keyword `:quit-when-no-windows`, such that the delivered application does not `quit` even after all CAPI windows are closed as long as `automation-server-top-loop` has not returned.

2. **automation-server-top-loop** does not return while the server is active. Typically it will be running on its own process.

3. **automation-server-top-loop** uses `mp:general-handle-event` to process Lisp events, so it is possible to run in the same thread operations that rely on such messages. In particular, CAPI windows can start on the same process. However, all COM input is processed in this thread, so it is probably better to start CAPI windows on other processes, so that they do not interfere with each other.

4. **automation-server-top-loop** does not return a useful value.

See also

- `start-factories`
- `stop-factories`
- `automation-server-main`
- `server-can-exit-p`
- `set-automation-server-exit-delay`

**call-com-interface**

*Macro*

Summary

Invokes a method from a particular COM interface.

Package

`com`

Signature

```
call-com-interface spec arg* => values  

spec ::= (interface-ptr interface-name method-name)
```
<table>
<thead>
<tr>
<th>Arguments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>spec</code></td>
<td>The interface pointer and a specification of the method to be called.</td>
</tr>
<tr>
<td><code>interface-ptr</code></td>
<td>A form which is evaluated to yield a COM interface pointer.</td>
</tr>
<tr>
<td><code>interface-name</code></td>
<td>A symbol which names the COM interface. It is not evaluated.</td>
</tr>
<tr>
<td><code>method-name</code></td>
<td>A symbol which names the method. It is not evaluated.</td>
</tr>
<tr>
<td><code>arg</code></td>
<td>Arguments to the method (see Section 1.7.1, “Data conversion when calling COM methods” for details).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>values</code></td>
<td>Values from the method (see Section 1.7.1, “Data conversion when calling COM methods” for details).</td>
</tr>
</tbody>
</table>

| Description        | The macro `call-com-interface` invokes the method `method-name` for the COM interface `interface-name`, which should be the type or a supertype of the actual type of `interface-ptr`. The `args` and `values` are described in detail in Section 1.7.1, “Data conversion when calling COM methods”. |

<table>
<thead>
<tr>
<th>Example</th>
<th>This example invokes the COM method <code>GetTypeInfo</code> in the interface <code>IDispatch</code>.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>`(defun get-type-info (disp tinfo &amp;key</td>
</tr>
<tr>
<td></td>
<td>(locale LOCALE_SYSTEM_DEFAULT))</td>
</tr>
<tr>
<td></td>
<td>(multiple-value-bind (hres typeinfo)</td>
</tr>
<tr>
<td></td>
<td>(call-com-interface</td>
</tr>
<tr>
<td></td>
<td>(disp i-dispatch get-type-info)</td>
</tr>
<tr>
<td></td>
<td>tinfo locale)</td>
</tr>
<tr>
<td></td>
<td>(check-hresult hres 'get-type-info) typeinfo))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>See also</th>
<th>with-com-interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>query-interface</td>
</tr>
</tbody>
</table>
call-com-object  

Macro

Summary
Invokes a COM method on a COM object.

Package
com

Signature
call-com-object spec arg* => values

spec ::= (object class-name method-spec &key interface)

method-spec ::= method-name | (interface-name method-name)

Arguments
spec The object and a specification of the method to be called.

object A form which is evaluated to yield a COM object.

class-name A symbol which names the COM implementation class. It is not evaluated.

method-spec Specifies the method to be called. It is not evaluated.

method-name A symbol naming the method to call.

interface-name A symbol naming the interface of the method to call. This is only required if the implementation class class-name has more than one method with the given method-name.

interface An optional form which when evaluated should yield a COM interface pointer. This is only needed if the definition of the method being called has the interface keyword in its class-spec.
## 2 COM Reference Entries

<table>
<thead>
<tr>
<th>arg</th>
<th>Arguments to the method (see Section 1.9.1, “Data conversion when calling COM object methods” for details).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>values</td>
</tr>
<tr>
<td>Description</td>
<td>The macro call-com-object invokes the method method-name for the COM class class-name, which should the type or a supertype of the actual type of object. The args and values are described in detail in Section 1.9.1, “Data conversion when calling COM object methods”.</td>
</tr>
<tr>
<td>Examples</td>
<td>(call-com-object (my-doc doc-impl move) 0 0)</td>
</tr>
<tr>
<td></td>
<td>(call-com-object (my-doc doc-impl resize) 100 200)</td>
</tr>
<tr>
<td>See also</td>
<td>with-com-object</td>
</tr>
<tr>
<td></td>
<td>query-object-interface</td>
</tr>
<tr>
<td></td>
<td>call-com-interface</td>
</tr>
</tbody>
</table>

### check-hresult

**Macro**

| Summary | Signals an error if a result code indicates a failure. |
| Package | com |
| Signature | check-hresult hresult function-name |
| Arguments | hresult | An integer hresult. |
| | function-name | A name for inclusion in the error message. |
The check-hresult macro checks the hresult and returns if the it is one of the 'succeeded' values, for instance S_OK or S_FALSE. Otherwise it signals an error of type com-error, which will include the function-name in its message.

Examples

(check-hresult S_OK "test") => nil
(check-hresult E_NOINTERFACE "test")
signals an error mentioning "test"

See also

succeeded
hresult
hresult-equal

**co-create-guid**

*Function*

**Summary**

Makes a unique refguid object.

**Package**

com

**Signature**

co-create-guid &key register => refguid

**Arguments**

register A generalized boolean.

**Values**

refguid A refguid object.

**Description**

The function co-create-guid makes a new unique refguid object. If register is true (the default), then the table of known refguids is updated.

**Examples**

Make a GUID without registering it in the table of known refguids:

(com:co-create-guid :register nil)
=>
#<REFGUID FOO C76B64AP-969A-4EFF-97BC-6CE2EB65019B>
See also  

refguid  
make-guid-from-string  
com-interface-refguid  
guid-equal  
guid-to-string  
refguid-interface-name

**co-initialize**  

**Function**  

**Summary**  
Initialize the COM library in the current thread.

**Package**  
com

**Signature**  
co-initialize &optional co-init

**Arguments**  
co-init  
Flags to specify the concurrency model and initialization options for the thread.

**Description**  
The function **co-initialize** initializes COM for the current thread. This must be called by every thread that uses COM client or server functions.

The default value of co-init is **COINIT_APARTMENTTHREADED**. Other flags are allowed as for the dwCoInit argument to CoInitializeEx.

**Examples**  
(co-initialize)

See also  
co-uninitialize

**co-task-mem-alloc**  

**Function**  

**Summary**  
Allocates a block of foreign memory for use in COM method argument passing.
Package: com

Signature: co-task-mem-alloc &key type pointer-type initial-element initial-contents nelems => pointer

Arguments:

- **type**: A FLI type specifying the type of the object to be allocated. If *type* is supplied, *pointer-type* must not be supplied.
- **pointer-type**: A foreign pointer type specifying the type of the pointer object to be allocated. If *pointer-type* is supplied, *type* must not be supplied.
- **initial-element**: A keyword setting the initial value of every element in the newly allocated object to *initial-element*.
- **initial-contents**: A list of forms which initialize the contents of each element in the newly allocated object.
- **nelems**: An integer specifying how many copies of the object should be allocated. The default value is 1.

Values: pointer

A pointer to the specified *type* or *pointer-type*.

Description: The function **co-task-mem-alloc** calls the C function `CoTaskMemAlloc()` to allocate a block of memory. The various arguments are handled in the same way as for the function **fli:allocate-foreign-object** (see the LispWorks Foreign Language Interface User Guide and Reference Manual).

Examples: Two ways to allocate memory for an integer:

(co-task-mem-alloc :type :int)

(co-task-mem-alloc :pointer-type '(:pointer :int))

See also: **co-task-mem-free**
co-task-mem-free

Function

Summary Frees a block of foreign memory used in COM method argument passing.

Package com

Signature co-task-mem-free pointer => pointer2

Arguments pointer A foreign pointer for the block to be freed.

Values pointer2 The same as pointer.

Description The function co-task-mem-free calls the C function CoTaskMemFree() to free a block of memory. The pointer should not be dereferenced after calling this function.

Example (co-task-mem-free ptr)

See also co-task-mem-alloc

cuo-uninitialize

Function

Summary Close the COM library in the current thread.

Package com

Signature co-uninitialize

Description The function co-uninitialize closes the COM library on the current thread. This should be called when COM is no longer required, for instance before exiting the application.

Examples (co-uninitialize)

See also co-initialize
**com-error**

**Condition Class**

**Summary**
The condition class used to signal errors from COM.

**Package**
com

**Superclasses**
c1: error

**Subclasses**
com-dispatch-invoke-exception-error

**Initargs**

- :hresult  
  An integer giving the *hresult* of the error.

- :function-name  
  Either nil or a string or symbol describing the function that generated the error.

**Readers**
com-error-hresult
com-error-function-name

**Description**
The class com-error is used by the Lisp COM API when signaling errors that originate as hresult code from COM.

**Example**
This function silently ignores the E_NOINTERFACE error:

```lisp
(defun call-ignoring-nointerface-error (function)
  (handler-bind ((com-error #'(lambda (condition)
                        (when (hresult-equal (com-error-hresult condition) E_NOINTERFACE)
                          (return-from call-ignoring-nointerface-error nil))))
                (funcall function)))
```

**See also**
check-hresult
hresult-equal
hresult
**com-interface**

**Class**

**Summary** The class of all COM interface pointers.

**Package** com

**Superclasses** fli:foreign-pointer

**Description** The class `com-interface` is used for all COM interface pointers.

**Example**
```
(typep (query-interface ptr 'i-unknown) 'com-interface)
=> t
```

**See also** call-com-interface

---

**com-interface-refguid**

**Function**

**Summary** Return the refguid object for a named COM interface.

**Package** com

**Signature**
```
com-interface-refguid interface-name => refguid
```

**Arguments**
- `interface-name` A symbol naming a COM interface.

**Values**
- `refguid` The refguid object matching `interface-name`.

**Description** The function `com-interface-refguid` returns a refguid object that matches `interface-name`, which should be a symbol as described in Section 1.3, “The mapping from COM names to Lisp symbols”. This definition of this COM interface must have been converted to Lisp FLI definitions as in Section 1.2.2, “Generating FLI definitions from COM definitions” or Section 3.1, “Including Automation in a Lisp application”.
Examples

(guid-to-string (com-interface-refguid 'i-unknown))
=> "00000000-0000-0000-C000-000000000046"

See also
refguid
guid-equal
guid-to-string
make-guid-from-string
refguid-interface-name

com-object

Class
Summary
The ancestor of an COM object implementation classes.

Package    com

Superclasses cl:standard-object

Subclasses standard-i-unknown

Description
The class com-object is the ancestor of all COM object
implementation classes. In general, it is more useful to inherit
from its subclass standard-i-unknown, which provides an
implementation of the i-unknown interface.

Example

For a COM object my-doc:
(typep my-doc 'com-object) => t

See also
standard-i-unknown

com-object-destructor

Generic Function
Summary
Called when a COM object loses its last interface pointer.

Package    com
The generic function `com-object-destructor` is called by the implementation of the class `standard-i-unknown` at the point where the last COM interface pointer is removed for the object, i.e. where the overall reference count becomes zero. After this, the object is known only to Lisp and is not involved in any COM operations and will be freed as normal by the garbage collector. The built-in primary method specializing on `standard-i-unknown` does nothing. The built-in around method specializing on `standard-i-unknown` frees the memory used by the COM interface pointers. Typically, after methods are defined to handle class-specific clean-ups.

This function should not be called directly by user code.

### Examples

```lisp
(defmethod com-object-destructor :after
  ((my-doc doc-impl))
  (close (document-file my-doc)))
```

### See also

- `com-object-initialize`
- `standard-i-unknown`

---

**Function**

### com-object-from-pointer

**Summary**

Return the COM object that implements a particular COM interface pointer.

**Package**

`com`
Signature  com-object-from-pointer  pointer => object  
Arguments  pointer  A foreign pointer.  
Values  object  A COM object or nil.  
Description  The function com-object-from-pointer returns the COM object that implements pointer. The value of pointer should be a foreign pointer or COM interface pointer that was created by LispWorks itself and implemented by a subclass of com-object. If pointer is not a known COM interface pointer then nil is returned.  
Example  (com-object-from-pointer my-ptr)  
See also  com-object  

com-object-initialize  
Generic Function  
Summary  Called when a COM object gets its first interface pointer.  
Package  com  
Signature  com-object-initialize  object  
Arguments  object  A COM object.  
Method Signatures  com-object-initialize (object standard-i-unknown)  
Description  The generic function com-object-initialize is called by the built-in class standard-i-unknown at the point where the first COM interface pointer is made for the object. Prior to this, the object is known only to Lisp and is not involved in any COM operations. The built-in primary method specializing on standard-i-unknown does nothing.
This function should not be called directly by user code.

Examples

(defmethod com-object-initialize :after
  ((my-doc doc-impl))
  (ensure-open-document-file my-doc))

See also
com-object-destructor
standard-i-unknown

com-object-query-interface  

Generic Function

Summary
Called by the built in implementation of query-interface.

Package  com

Signature
com-object-query-interface object iid

Arguments
object  A COM object.
iid  A GUID foreign pointer.

Method Signatures
com-object-query-interface (object standard-i-unknown)
(iid t)

Description
The generic function com-object-query-interface is called by the built-in implementation of query-interface for the class standard-i-unknown. The built-in primary method specializing on standard-i-unknown handles the i-unknown interface and all the interfaces specified by the define-com-implementation form for the class of object.

In most cases, there is no need to specialize this generic function for user-defined classes.

This function should not be called directly by user code.

See also
define-com-implementation
standard-i-unknown
**create-instance**

**Function**

**Summary**
Starts the implementation of a remote COM object and returns its interface pointer.

**Package**
com

**Signature**
create-instance clsid &key unknown-outer clsctx riid errorp => interface-ptr

**Arguments**

- **clsid**
  A string or a refguid giving a CLSID to create.

- **unknown-outer**
  A COM interface pointer specifying the outer i-unknown if the new instance is to be aggregated.

- **clsctx**
  A CLSCTX value, which defaults to CLSCTX_SERVER.

- **riid**
  An optional refiid giving the name of the COM interface return.

- **errorp**
  A boolean. The default is t.

**Values**

- **interface-ptr**
  A COM interface pointer for riid.

**Description**
Creates an instance of the COM server associated with clsid and returns an interface pointer for its riid interface. If riid is nil, then i-unknown is used.

If the server cannot be started, then an error of type com-error will be signaled if errorp is true, otherwise nil will be returned.

If unknown-outer is non-nil, it will be passed as the outer unknown interface to be aggregated with the new instance.

**Notes**
To create an i-dispatch interface and set an event handler, you can use create-instance-with-events.
Example

(create-instance
  "000209FF-0000-0000-C000-000000000046")

See also

refguid
refiid
i-unknown
create-object
create-instance-with-events

define-com-implementation

Macro

Summary
Defines an implementation class for a particular set of interfaces.

Package
com

Signature
define-com-implementation class-name (superclass-name*)
(slot-specifier*) class-option*

Arguments
class-name A symbol naming the class to define.
 superclass-name A symbol naming a superclass to inherit from.
 slot-specifier A slot description as used by defclass.
 class-option An option as used by defclass.

Description
The macro define-com-implementation defines a standard-class which is used to implement a COM object. Normal defclass inheritance rules apply for slots and Lisp methods.

Each superclass-name argument specifies a direct superclass of the new class, which can be another COM implementation class or any other standard-class provided that com-object is included somewhere in the overall class precedence list. To get the built-in handling for the i-unknown
interface, inherit from standard-i-unknown (which is the default superclass if no others are specified).

The slot-specifiers are standard defclass slot definitions.

The class-options are standard defclass options. In addition the following options are recognized:

(:interfaces  interface-name*)

Each interface-name specifies a COM interface that the object will implement. i-unknown should not be specified unless the you wish to replace the standard implementation provided by standard-i-unknown. If more than one interface-name is given then all the methods must have different names (except for those which are inherited from a common parent interface).

(:inherit-from  class-name  interface-name*)

This indicates that the class will inherit the implementation of all the methods in the interfaces specified by the interface-names directly from class-name. The class-name must be one of the direct or indirect superclasses of the class being defined. Without this option, methods from superclasses are inherited indirectly and can be shadowed in the class being defined. Use of :inherit-from allows various internal space-optimizations.

For example, given a COM class foo-impl which implements the i-foo interface, this definition of bar-impl:

(define-com-implementation bar-impl (foo-impl)
 ()
 (:interfaces i-foo))
will allow methods from \textit{i-foo} to be shadowed whereas this definition:

\begin{verbatim}
(define-com-implementation bar-impl (foo-impl)
  (:interfaces i-foo)
  (:inherit-from foo-impl i-foo))
\end{verbatim}

will result in an error if a method from \textit{i-foo} is redefined for \textit{bar-impl}.

\begin{verbatim}
(:dont-implement interface-name*)
\end{verbatim}

This option tells \texttt{standard-i-unknown} that it should not respond to \texttt{query-interface} for the given \textit{interface-names} (which should be parents of the interfaces implemented by the class being defined). Normally, \texttt{standard-i-unknown} will respond to \texttt{query-interface} for a parent interface by returning a pointer to the child interface.

For example, given an interface \textit{i-foo-internal} and sub-interface \textit{i-foo-public}, the following definition

\begin{verbatim}
(define-com-implementation foo-impl ()
  ()
  (:interfaces i-foo-public))
\end{verbatim}

specifies that \texttt{foo-impl} will respond to \texttt{query-interface} for \textit{i-foo-public} and \textit{i-foo-internal}, whereas the following definition

\begin{verbatim}
(define-com-implementation foo-impl ()
  (:interfaces i-foo-public)
  (:dont-implement i-foo-internal))
\end{verbatim}

specifies that \texttt{foo-impl} will respond to \texttt{query-interface} for \textit{i-foo-public} only.

**Examples**

\begin{verbatim}
(define-com-implementation i-robot-impl ()
  ((tools :accessor robot-tools))
  (:interfaces i-robot))
\end{verbatim}
(define-com-implementation i-r2d2-impl (i-robot-impl)
  ()
  (:interfaces i-robot i-r2d2)
)

See also
define-com-method
standard-i-unknown

define-com-method

Macro

Summary
The define-com-method macro is used to define a COM method for a particular implementation class.

Package
com

Signature
define-com-method method-spec (class-spec arg-spec*) form*
method-spec ::= method-name | (interface-name method-name)
class-spec ::= (this class-name &key interface)
arg-spec ::= (parameter-name [direction [pass-style]])

Arguments
method-spec Specifies the method to be defined.
method-name A symbol naming the method to define.
interface-name A symbol naming the interface of the method to define. This is only required if the implementation class class-name has more than one method with the given method-name.
class-spec Specifies the implementation class and variables bound to the object with in the forms.
this A symbol which will be bound to the COM object whose method is being invoked.
class-name A symbol naming the COM implementation class for which this method is defined.
interface  A optional symbol which will be bound to the COM interface pointer whose method is being invoked. Usually this is not needed unless the interface pointer is being passed to some other function in the implementation.

arg-spec  Describes one of the method’s arguments.

parameter-name  A symbol which will be bound to that argument’s value while the forms are evaluated.

direction  Specifies the direction of the argument, either :in, :out or :in-out. If specified, it must match the definition of the interface. The default is taken from the definition of the interface.

pass-style  Specifies how the argument will be converted to a Lisp value. It can be either :lisp or :foreign, the default is :lisp.

form  Forms which implement the method. The value of the final form is returned as the result of the method.

Description  

The macro define-com-method defines a COM method that implements the method method-name for the COM implementation class class-name. The extended method-spec syntax is required if class-name implements more than one interface with a method called method-name (analogous to the C++ syntax InterfaceName::MethodName).

The symbol this is bound to the instance of the COM implementation class on which the method is being invoked. The symbol this is also defined as a local macro (as if by with-com-object), which allows the body to invoke other methods on the instance.

If present, the symbol interface is bound to the interface pointer on which the method is being invoked.
Each foreign argument is converted to a Lisp argument as specified by the pass-style. See Section 1.8.6, “Data conversion in define-com-method” for details.

If an error is to be returned from an Automation method, the function set-error-info can be used to provide more details to the caller.

Example

```lisp
(define-com-method (i-robot rotate)
  ((this i-robot-impl)
   (axis :in)
   (angle-delta :in))
  (let ((joint (find-joint axis)))
    (rotate-joint joint))
  S_OK)
```

See also

define-com-implementation
set-error-info
set-variant

**find-clsid**

*Function*

**Summary**

Searches the registry for a GUID or ProgId.

**Package**

com

**Signature**

`find-clsid name &optional errorp => refguid`

**Arguments**

- `name` A string or a refguid.
- `errorp` A generalized boolean.

**Values**

- `refguid` A refguid.

**Description**

The function **find-clsid** searches for the supplied GUID or ProgId in the registry.
name can be a string representing a GUID (with or without the curly brackets) or a string containing a ProgId. Otherwise name can be a refguid, which is simply returned.

If find-clsid fails to find the GUID, it either signals an error or returns nil, depending on the value of errorp. The default value of errorp is t.

Example
To find the GUID of the Explorer ActiveX:

(com:find-clsid "Shell.Explorer")

get-object

Function

Summary
Returns an interface pointer for a named object.

Signature
get-object name &key riid errorp => interface-ptr

Arguments
name A string.

riid An optional refiid giving the name of the COM interface return.

errorp A boolean. The default value is t.

Values
interface-ptr A COM interface pointer for riid.

Description
The function get-object finds an existing object named by name in the Running Object Table or activates the object if it is not running.

get-object returns an interface pointer for the object's riid interface. If riid is nil, then i-unknown is used.

If an error occurs, an error of type com-error will be signaled if errorp is non-nil, otherwise nil will be returned.

Example
If C:\temp\spreadsheet.xls is open in Microsoft Excel 2007, then its WorkBook interface can be obtained using
(get-object "c:\Temp\spreadsheet.xls"
   :riid 'i-dispatch)

See also  
create-instance  
create-object  
get-active-object

**guid-equal**

*Function*

**Summary**
Compares the GUID data in two GUID pointers.

**Package**
com

**Signature**
guid-equal guid1 guid2 => flag

**Arguments**
guid1  
A foreign pointer to a GUID object.
guid2  
A foreign pointer to a GUID object.

**Values**
flag  
A boolean, true if guid1 and guid2 contain the same GUID data.

**Description**
The function `guid-equal` compares the GUID data in guid1 and guid2 and returns true if the data is identical.

**Examples**

```
(guid-equal (com-interface-refguid 'i-unknown)
   (com-interface-refguid 'i-dispatch))
=> nil

(guid-equal (com-interface-refguid 'i-unknown)
   (make-guid-from-string  
   "00000000-0000-0000-C000-000000000046"))
=> t
```

See also  
refguid  
com-interface-refguid  
guid-to-string  
make-guid-from-string  
refguid-interface-name
guid-to-string  

**Function**

**Summary**
Converts a GUID to a string of hex characters.

**Package**
com

**Signature**
guid-to-string guid => guid-string

**Arguments**
guid  
A foreign pointer to a GUID object.

**Values**
guid-string  
A string in the standard hex format for GUIDs.

**Description**
The function `guid-to-string` converts the data in the `guid` to a string of hex characters in the standard format.

**Example**

```lisp
(guid-to-string (com-interface-refguid 'i-unknown))
=> "00000000-0000-0000-C000-000000000046"
```

**See also**
- refguid
- com-interface-refguid
- guid-equal
- make-guid-from-string
- refguid-interface-name

hresult  

**FLI type descriptor**

**Summary**
The FLI type corresponding to HRESULT in C/C++.

**Package**
com

**Signature**
hresult

**Description**
The `hresult` type is a signed 32 bit integer. When used as the result type of a COM method, the value `E_UNEXPECTED` is returned if the COM method body does not return an integer.
See also

hresult-equal
check-hresult

hresult-equal

Function

Summary
Compares one hresult to another.

Package
com

Signature
hresult-equal hres1 hres2 => flag

Arguments
hres1 An integer hresult.

hres2 An integer hresult.

Values
flag A boolean, true if hres1 and hres2 are equal.

Description
The function hresult-equal compares hres1 and hres2 and returns true if they represent the same hresult. This function differs from the Common Lisp function eql because it handles signed and unsigned versions of each hresult.

Example
E_NOTIMPL is negative, so

(eql E_NOTIMPL 2147500033)
=> nil

(hresult-equal E_NOTIMPL 2147500033)
=> t

See also
hresult
check-hresult
com-error

i-unknown

COM Interface Type

Summary
The Lisp name for the IUnknown COM interface.
Package com

Description The symbol i-unknown is the name given to the IUnknown COM interface within Lisp. The name results from the standard mapping described in Section 1.3, “The mapping from COM names to Lisp symbols”.

Examples (query-interface ptr 'i-unknown)

See also standard-i-unknown i-dispatch

interface-ref  

Macro

Summary Accesses a place containing an interface pointer, maintaining reference counts.

Package com

Signature interface-ref iptr => iptr

(setf interface-ref) new-value iptr => new-value

Arguments iptr A place containing a COM interface pointer or nil.

new-value A COM interface pointer or nil.

Description interface-ref is useful when manipulating a place containing an interface pointer.

The setf expander increments the reference count, as if by add-ref, of new-value, unless it is nil. It then decrements the reference count, as if by release, of the existing value in iptr, unless this is nil. Note that this order is important in the case that the new value is the same as the current value. Finally the value of place iptr is set to new-value.
The reader `interface-ref` simply returns its argument and does no reference counting. It may be useful in a form which both reads and writes a place like `incf`.

See also `add-ref`  
`release`

### make-factory-entry

**Summary**  
Make a object which can be used to register a class factory.

**Package**  
com

**Signature**  
`make-factory-entry &key clsid implementation-name constructor-function constructor-extra-args friendly-name prog-id version-independent-prog-id`

**Arguments**

- `clsid`  
The CLSID of the coclass.

- `implementation-name`  
A Lisp symbol naming the implementation class.

- `constructor-function`  
A function to construct the object. If `nil`, the default constructor is used which makes an instance of the `implementation-name` and queries it for a `i-unknown` interface pointer. The default constructor also handles aggregation.

- `constructor-extra-args`  
Extra arguments to pass to the `constructor-function`.

- `friendly-name`  
The name of the coclass for use by application builders.

- `prog-id`  
The ProgID of the coclass.
version-independent-prog-id

The VersionIndependentProgID of the coclass.

Description
Makes an object to contain all the information for class factory registration in the COM runtime. This object should be passed to register-class-factory-entry to perform the registration. This done automatically if you use define-automation-component described in the Chapter 3, “Using Automation”.

Examples
(make-factory-entry
 :clsid (make-guid-from-string
 "7D9EB762-E4E5-11D5-BF02-000347024BE1")
 :implementation-name 'doc-impl
 :prog-id "Wordifier.Document.1"
 :version-independent-prog-id "Wordifier.Document"
 :friendly-name "Wordifier Document")

See also register-class-factory-entry

make-guid-from-string

Function

Summary Make a refguid object from a hex string.

Package com

Signature make-guid-from-string string &optional interface-name => refguid

Arguments string A string in the standard hex format for GUIDs.
interface-name A symbol naming a COM interface. If non-nil, the refguid will be will added to the table of known refguids.

Values refguid A refguid object matching string.
Description
The function `make-guid-from-string` makes a `refguid` object from `string`. If the GUID data matches a known `refguid`, then that is returned. Otherwise, a new `refguid` is created and returned. If `interface-name` is non-nil, then the table of known `refguids` is updated. If the GUID is already known under a different name, an error is signaled.

Examples
This GUID is a predefined one for `i-unknown`:

```
(refguid-interface-name
 (make-guid-from-string
   "00000000-0000-0000-C000-000000000046"))
=> I-UNKNOWN
```

See also
`refguid`
`com-interface-refguid`
`guid-equal`
`guid-to-string`
`refguid-interface-name`

midl

**Function**

Summary
Converts an IDL file into Lisp FLI definitions.

Package
`com`

Signature
`midl file &key package depth mapping-options output-file load import-search-path`

Arguments
`file` A pathname designator giving the name of an IDL file.
`package` The package in which definitions are created. Defaults to the current package.
`depth` How many levels of IDL `import` statement to convert to Lisp. This defaults to 0, which means only convert definitions for the IDL file itself. Imported files should be converted
and loaded before the importing file. Some of the standard files are preloaded, so should not be loaded again (see Section 1.2.3, “Standard IDL files”).

**mapping-options** Allows options to be passed controlling the conversion of individual definitions.

**output-file** If this is `nil` (the default), the IDL file is compiled in-memory. Otherwise a Lisp fasl is produced so the definitions can be reloaded without requiring recompilation. If `output-file` is `t` then the fasl is named after the IDL file, otherwise `output-file` is used as a pathname designator to specify the name of the fasl file.

**load** If this is true (the default) then any fasl produced is loaded after being compiled. Otherwise, the fasl must be loaded explicitly with `load`. This argument has no effect if `output-file` is `nil`.

**import-search-path**

Specifies where to look for files referenced by `import` statements in the IDL. The default value, which is `:default`, causes a search in the same directory as `file`. Otherwise the value should be a list of pathname designators specifying directories to search. After searching using the value of `import-search-path`, `midl` looks in any directory in the list that was set by `midl-set-import-paths` or the `INCLUDE` environment variable, and then the directories that are returned by `midl-default-import-paths`.

**Description** This function is used to convert an IDL file into Lisp FLI definitions, which is necessary before the types in the file can be used from the Lisp COM API. See Section 1.3, “The mapping
from COM names to Lisp symbols” for the details on how these FLI definitions are named.

Import paths

When the file that midl processes contains import statements (which is the normal case, because at least "unkwn.idl" is needed), midl looks for the imported file in these directories:

1. The directory in the import-search-path argument, or if it is :default in the directory of the file argument.  
   **Note:** you can pass import-search-path as nil to prevent searching in the directory of file. In many cases that is the more useful behavior.

2. The directories in the list that was set by midl-set-import-paths, or if it is :default the directories in the INCLUDE environment variable.

3. The directories in the list that is returned by midl-default-import-paths.

The recommended way of getting the standard files to import is to install Windows SDK from microsoft.com. If you install it in the default place, midl-default-import-paths should be able to find the right paths. Thus normally installing the Windows SDK is all you need to do to get the standard midl files.

**Notes**

midl requires that types like IDispatch are declared before they are used.

**Examples**

To compile myfile.idl into memory:

```
(midl "myfile.idl")
```

To compile myfile.idl to myfile.ofasl:

```
(midl "myfile.idl" :output-file t :load nil)
```

To compile myfile.idl to myfile.ofasl and load it:
See also :midl-file

midl-default-import-paths

Function

Summary
Returns the default directories for midl to search for imported idl files.

Package
com

Signature
midl-default-import-paths => paths-list

Arguments
None.

Values
paths-list A list.

Description
The function midl-default-import-paths returns the default directories for midl to search for imported idl files. See midl for more details.

You can call midl-default-import-paths to see what paths midl is going to use. Microsoft do not actually document where you should be looking for imported files, so there is an element of guessing in midl-default-import-paths, but if you install the Windows SDK in the default place it should work.

If the Windows SDK is not installed, midl-default-import-paths tries to see if the PlatformSDK (the previous incarnation of the Windows SDK) is installed, and uses it instead.

See also midl
**midl-set-import-paths**  

*Function*

**Summary**
Sets an internal list for midl to search for imported files.

**Package**
com

**Signature**
`midl-set-import-paths paths-list`

**Arguments**
`paths`  
A list of *path-specs* (see below), a single *path-spec* or the keyword `:default`.

**Values**
None.

**Description**
The function `midl-set-import-paths` sets an internal list for midl to search for imported files. This list overrides the value of the `INCLUDE` environment variable.

*paths-list* can be either a list of *path-specs*, where a *path-spec* is either a pathname or a string, or a single *path-spec*, which is interpreted as a list of this *path-spec*. It can also be the keyword `:default`, which resets it so it uses the `INCLUDE` environment variable.

**Notes**
In most cases midl should be able to find the imported files in the list that is returned by `midl-default-import-paths`, so `midl-set-import-paths` should rarely be useful.

**See also**
midl

---

**:midl-file**  

*Defsystem Member Type*

**Summary**
The :midl-file defsystem member type can be used to include IDL files in a Lisp system definition.

**Package**
com
When a file is given the type :midl-file, compiling the system will compile the IDL file to produce a fasl. Loading the system will load this fasl. The :package, :mapping-options and :import-search-path keywords can specified as for midl.

```
;; Include the file myfile.idl in a system
(defsystem my-system ()
   :members (("myfile.idl" :type :midl-file)))
```

See also midl

**Function**

**query-interface**

**Summary**

Attempts to obtain a COM interface pointer for one interface from another.

**Package**

com

**Signature**

query-interface interface-ptr iid &key errorp => interface-for-iid

**Arguments**

- **interface-ptr** A COM interface pointer to be queried.
- **iid** The iid of a COM interface.
- **errorp** A boolean. The default is t.

**Values**

interface-for-iid The new COM interface pointer or nil.

**Description**

The function query-interface function invokes the COM method IUnknown::QueryInterface to attempt to obtain an interface pointer for the given iid. The iid can be a symbol naming a COM interface or a refguid foreign pointer containing its iid.

If the IUnknown::QueryInterface returns successfully then the new interface pointer interface-for-iid is returned.
If `errorp` is true, then `nil` is returned if the interface pointer cannot be found, otherwise an error of type `com-error` is signaled.

Example

```
(query-interface p-foo 'i-bar)
```

See also

`refguid`  
`com-error`  
`add-ref`  
`release`  
`with-temp-interface`  
`with-query-interface`

---

**query-object-interface**

*Macro*

**Summary**

Obtains a COM interface pointer for a particular interface from a COM object.

**Package**

`com`

**Signature**

```
query-object-interface class-name object iid &key ppo-object  
=> hresult, interface.ptr-for-iid
```

**Arguments**

- `class-name` The COM object class name of the `object`. This can be a superclass name.
- `object` A COM object to be queried.
- `iid` The iid of a COM interface.
- `ppv-object` If specified, this should be a foreign pointer which will be set to contain the `interface.ptr-for-iid`.

**Values**

- `hresult` The `hresult`.
- `interface.ptr-for-iid` The new interface pointer or `nil` if none.
Description

The macro `query-object-interface` invokes the COM method `IUnknown::QueryInterface` to attempt to obtain an interface pointer for the given `iid`. The `iid` can be a symbol naming a COM interface or a `refguid` foreign pointer containing its iid.

The first value is the integer `hresult` from the call to `IUnknown::QueryInterface`. If the result indicates success, then `interface-ptr-for-iid` is returned as the second value.

Example

```lisp
(qquery-object-interface foo-impl p-foo 'i-bar)
```

See also `refguid` `hresult`

---

**refguid**

*FLI type descriptor*

Summary

A FLI type used to refer to GUID objects.

Package

`com`

Signature

`refguid`

Description

The `refguid` type is a pointer to a GUID structure, like the type `REFGUID` in C. In addition, a table of named `refguids` is maintained, using the names chosen when COM interface types are converted to a Lisp FLI definitions by `midl` or parsing a type library.

Example

```lisp
(typep (com-interface-refguid 'i-unknown) 'refguid)
=> t
```

See also `com-interface-refguid` `guid-equal` `guid-to-string` `make-guid-from-string` `refguid-interface-name`
refguid-interface-name  

**Function**

**Summary**
Returns the COM interface name of a refguid if known.

**Package**
com

**Signature**
refguid-interface-name refguid => interface-name

**Arguments**
refguid  
A refguid object.

**Values**
interface-name  
A symbol naming the COM interface of refguid.

**Description**
Returns a symbol naming the COM interface of refguid, which must be a refguid object known to Lisp.

**Example**
(refguid-interface-name  
(make-guid-from-string  
"00000000-0000-0000-C000-000000000046")  
) => i-unknown

**See also**
refguid  
com-interface-refguid  
guid-equal  
guid-to-string  
make-guid-from-string

refiid  

**FLI type descriptor**

**Summary**
A FLI type used to refer to iids.

**Package**
com
The refIID foreign type is a useful converted type for iid arguments to foreign functions. When given a symbol, it looks up the GUID as if by calling com-interface-refguid. Otherwise the value should be a foreign pointer to a GUID structure, which is passed directly without conversion.

Example
Given the definition of print-iid:

```lisp
(ffi:define-foreign-function print-iid
   ((iid refiid)))
```
then these two forms are equivalent:

```lisp
(print-iid 'i-unknown)
(print-iid (com-interface-refguid 'i-unknown))
```

See also com-interface-refguid
refguid

register-class-factory-entry  

Function

Summary Registers the description of a class factory.

Package com

Signature register-class-factory-entry new-factory-entry

Arguments new-factory-entry

A factory entry from make-factory-entry.

Description Register the factory entry with the COM runtime so that register-server, unregister-server, start-factories and stop-factories will know about the coclass in the factory entry. This is done automatically if you use
**define-automation-component** described in the Chapter 3, “Using Automation”.

Examples

See also  
make-factory-entry  
start-factories  
stop-factories  
register-server  
unregister-server

---

**register-server**  
*Function*

**Summary**  
Externally registers all class factories known to Lisp.

**Package**  
com

**Signature**  
`register-server &key clsctx`

**Arguments**  
`clsctx`  
The CLSCTX in which to register the class factory.

**Description**  
The `register-server` function updates the Windows registry to contain the appropriate keys for all the class factories registered in the current Lisp image. For Automation components, the type libraries are registered as well. During development, the type library will be found wherever the system definition specified, but after using LispWorks delivery it must be located in the directory containing the application’s executable or DLL.

This function should be called when an application is installed, usually by detecting the `/RegServer` command line argument.

When running on 64-bit Windows, 32-bit LispWorks updates the 32-bit registry view and 64-bit LispWorks updates the 64-
bit registry view. LispWorks does not change the registry reflection settings.

**Example**

```lisp
(defun start-up-function ()
  (cond ((member "\RegServer" system:*line-arguments-list*
               :test 'equalp)
         (register-server))
        ((member "\UnRegServer" system:*line-arguments-list*
               :test 'equalp)
         (unregister-server))
        (t
         (co-initialize)
         (start-factories)
         (start-application-main-loop)))
  (quit))
```

**See also**

unregister-server  
register-class-factory-entry  
start-factories  
stop-factories  
set-register-server-error-reporter  

---

### release

**Function**

**Summary**

The `release` function decrements the reference count of an interface pointer.

**Package**

`com`

**Signature**

`release interface-ptr => ref-count`

**Arguments**

`interface-ptr` A COM interface pointer.

**Values**

`ref-count` The new reference count.
Description
Each COM interface pointer has a reference count which is used by the server to control its lifetime. The function release should be called whenever a reference to the interface pointer is being removed. The function invokes the COM method IUnknown::Release so the form (release ptr) is equivalent to using call-com-interface as follows:

(call-com-interface (ptr i-unknown release))

Example
(release p-foo)

See also
add-ref
interface-ref
query-interface
with-temp-interface

s_ok

Summary
Compares a result code to the value of s_ok.

Package
com

Signature
s_ok hresult => flag

Arguments
hresult An integer hresult.

Values
flag A boolean.

Description
The s_ok macro checks the hresult and returns true if its value is that of the constant S_OK.

Examples
(S_OK S_OK) => t
(S_OK S_FALSE) => nil
(S_OK E_NOINTERFACE) => nil
See also succeeded hresult hresult-equal check-hresult

server-can-exit-p
server-in-use-p

Summary Predicates for whether a COM server is in use or can exit.

Package com

Signature server-can-exit-p => result
Signature server-in-use-p => result

Arguments None.

Values result A boolean.

Description The function server-in-use-p returns true when the COM server is in use, which means one or more of the following:

1. There are live objects other than the class factories.
2. Any of the class factories has more than one reference.
3. The server is locked by a client call to the COM method IClassFactory::LockServer.

The function server-can-exit-p returns true if the server can exit, which means that the server is not in use (that is, (not (server-in-use-p)) returns t), and also that there are no other "working processes", which means that all other processes except the one that calls server-can-exit-p are "Internal servers" (see mp:process-run-function).
The main purpose of server-can-exit-p is to be the exit-function for automation-server-top-loop, either as the default or called from a supplied exit-function.

See also automation-server-top-loop

**set-automation-server-exit-delay**

*Function*

**Summary**
Sets the exit-delay used by automation-server-top-loop.

**Package**
com

**Signature**
set-automation-server-exit-delay exit-delay

**Arguments**
exit-delay A non-negative real number specifying a time in seconds.

**Description**
The function set-automation-server-exit-delay sets the exit-delay which is used by automation-server-top-loop to delay exiting once the server is unused.

set-automation-server-exit-delay can be called both before and after automation-server-top-loop, and can be used repeatedly after automation-server-top-loop was called to dynamically change the exit-delay. The setting persists over saving and delivering an image, so it can be used in the delivery script too.

See also automation-server-top-loop

**set-register-server-error-reporter**

*Function*

**Summary**
Allows control over the reporting, logging or debugging of failures from register-server and unregister-server.
Package  com

Signature  set-register-server-error-reporter  func => func

Arguments  func  A function or a fbound symbol.

Values  func  A function or a fbound symbol.

Description  The function set-register-server-error-reporter sets up a function func that is called to report when calls and automatic calls to register-server or unregister-server via the system-defined entry points of a DLL fail.

func should be a function of two arguments.

The automatic calls happen when registering/unregistering a LispWorks DLL that was saved or delivered with the keyword :com in its :dll-exports (see “Making a COM DLL with LispWorks” on page 2). If such a call fails, func is invoked with the name of the function that failed (currently either register-server or unregister-server) and the condition. func should report the failure in a useful way, which would normally mean logging it in a place where you can inspect it later.

Notes

1. After func returns or throws out, the automatic call returns with an appropriate failure code, and the code that tries to register (that is, the program that called DllRegisterServer or DllUnregisterServer) should normally print an error too. For example, regsvr32 would raise a dialog by default. However, this dialog will not contain any information about what failed inside Lisp.

2. By default (that is, if you do not call set-register-server-error-reporter) any such error is simply printed to standard output.
3. func can force entering the debugger using cl:invoke-debugger, which may sometimes be useful during development.

See also register-server
unregister-server

**standard-i-unknown**

Summary A complete implementation of the i-unknown interface.

Package com

Superclasses com-object

Subclasses standard-i-dispatch
standard-i-connection-point-container

Initargs :outer-unknown
An optional interface pointer to the outer unknown interface if this object is aggregated.

Description The class standard-i-unknown provides a complete implementation of the i-unknown interface.

The class provides a reference count for the object which calls the generic function com-object-initialize when the object is given a reference count and com-object-destructor when it becomes zero again. These generic functions can be specialized to perform initialization and cleanup operations.

The class also provides an implementation of query-interface which calls the generic function com-object-query-interface. The default method handles i-unknown and all the interfaces specified by the
define-com-implementation form for the class of the object.

There is support for aggregation via the :outer-unknown initarg, which is also passed by built-in class factory implementation.

Example

Inheriting from a non-COM class requires standard-i-unknown to be mentioned explicitly:

```lisp
(define-com-implementation doc-impl
  (document-mixin
    standard-i-unknown)
  ()
  (:interfaces i-doc))
```

See also

define-com-implementation
standard-i-dispatch
standard-i-connection-point-container
com-object-initialize
com-object-destructor
com-object-query-interface
com-object
i-unknown

### start-factories

*Function*

**Summary**

Starts all the registered class factories.

**Package**

com

**Signature**

`start-factories &optional clsctx`

**Arguments**

`clsctx` The CLSCTX in which to start the factories.

**Description**

The `start-factories` function starts all the registered class factories in the given `clsctx`, which defaults to CLSCTX_LOCAL_SERVER. This function should be called once
when a COM server application starts if it has externally registered class factories.

See also

- `register-class-factory-entry`
- `stop-factories`
- `register-server`
- `unregister-server`
- `co-initialize`

---

### stop-factories

**Function**

**Summary**

Stops all the registered class factories.

**Package**

`com`

**Signature**

`stop-factories`

**Description**

The `stop-factories` function stops all the registered class factories. This function should be called once before a COM server application exits if it has externally registered class factories.

See also

- `register-class-factory-entry`
- `start-factories`
- `register-server`
- `unregister-server`
- `co-uninitialize`

---

### succeeded

**Macro**

**Summary**

Checks an `hresult` for success.

**Package**

`com`

**Signature**

`succeeded hresult => flag`
Arguments

\( hresult \)  
An integer \( hresult \).

Values

\( flag \)  
A boolean.

Description

The \texttt{succeeded} macro checks the \( hresult \) and returns true if the it is one of the 'succeeded' values, for instance \texttt{S_OK} or \texttt{S_FALSE}.

Examples

\[
\begin{align*}
\text{(succeeded S_OK)} & \Rightarrow t \\
\text{(succeeded E_NOINTERFACE)} & \Rightarrow \text{nil}
\end{align*}
\]

See also  
\texttt{check-hresult}  
\texttt{hresult}  
\texttt{hresult-equal}  
\texttt{s_ok}

\textbf{unregister-server}  
\textit{Function}

Summary

Externally unregisters all class factories known to Lisp.

Package

\texttt{com}

Signature

\texttt{unregister-server}

Description

The \texttt{unregister-server} function updates the Windows registry to remove the appropriate keys for all the class factories registered in the current Lisp image. For Automation components, the type libraries are unregistered as well.

This function should be called when an application is uninstalled, usually by detecting the \texttt{/UnRegServer} command line argument.

When running on 64-bit Windows, 32-bit LispWorks updates the 32-bit registry view and 64-bit LispWorks updates the 64-bit registry view. LispWorks does not change the registry reflection settings.
Example

(defun start-up-function ()
  (cond ((member "/UnRegServer" 
             system:*line-arguments-list* 
             :test 'equalp)
         (unregister-server))
    ((member "/RegServer" 
             system:*line-arguments-list* 
             :test 'equalp)
         (register-server))
    (t
     (co-initialize)
     (start-factories)
     (start-application-main-loop)))
  (quit))

See also
register-server
register-class-factory-entry
start-factories
stop-factories
set-register-server-error-reporter

with-com-interface  

Macro

Summary  
Used to simplify invocation of several methods from a particular COM interface pointer.

Package  
com

Signature  
with-com-interface disp interface-ptr form* => values  
disp ::= (dispatch-function interface-name)

Arguments  
disp  
The names of the dispatch function and interface.

dispatch-function  
A symbol which will be defined as a local macro, as if by macrolet. The macro can be used by the forms to invoke the methods on interface-ptr.
interface-name A symbol which names the COM interface.  
It is not evaluated.

interface-ptr A form which is evaluated to yield a COM 
interface pointer that implements 
interface-name.

form A form to be evaluated.

Values values The values returned by the last form.

Description When the macro with-com-interface evaluates the forms, 
the local macro dispatch-function can be used to invoked the 
methods for the COM interface interface-name, which should 
be the type or a supertype of the actual type of interface-ptr. 
The dispatch-function macro has the following signature:

dispatch-function method-name arg* => values

where

method-name A symbol which names the method. It is not 
evaluated.

arg Arguments to the method (see Section 1.7.1, 
“Data conversion when calling COM meth- 
ods” for details).

values Values from the method (see Section 1.7.1, 
“Data conversion when calling COM meth-
ods” for details).

Example This example invokes the COM method GetTypeInfo in the 
interface IDispatch.

(defun get-type-info (disp tinfo &key 
  (locale LOCALE_SYSTEM_DEFAULT))
  (multiple-value-bind (hres typeinfo)
      (with-com-interface (call-disp i-dispatch) disp
        (call-disp get-type-info tinfo locale))
      (check-hresult hres 'get-type-info) 
      typeinfo))
See also  

**with-com-object**  

*Macro*

**Summary**  
Used to simplify invocation of several methods from a given COM object.

**Package**  
com

**Signature**  

```
with-com-object disp object form* => values
```

```
disp ::= (dispatch-function class-name &key interface)
```

**Arguments**

- `disp`  
The names of the dispatch function and object class.

- `dispatch-function`  
A symbol which will be defined as a macro, as if by `macrolet`. The macro can be used by the `forms` to invoke the methods on `object`.

- `class-name`  
A symbol which names the COM implementation class. It is not evaluated.

- `interface`  
An optional form which when evaluated should yield a COM interface pointer. This is only needed if the definition of the methods being called have the `interface` keyword in their `class-specs`.

- `object`  
A form which is evaluated to yield a COM object.

- `form`  
A form to be evaluated.

**Values**

- `values`  
The values returned by the last `form`.

**Description**  
When the macro `call-com-object` evaluates the `forms`, the local macro `dispatch-function` can be used to invoked the methods for the COM class `class-name`, which should be the type or a supertype of the actual type of `object`. 
The *dispatch-function* macro has the following signature:

*dispatch-function* method-spec arg* => values

*method-spec* ::= method-name | (interface-name method-name)

where

- **method-spec**: Specifies the method to be called. It is not evaluated.
- **method-name**: A symbol naming the method to call.
- **interface-name**: A symbol naming the interface of the method to call. This is only required if the implementation class *class-name* has more than one method with the given *method-name*.
- **arg**: Arguments to the method (see Section 1.9.1, “Data conversion when calling COM object methods” for details).
- **values**: Values from the method (see Section 1.9.1, “Data conversion when calling COM object methods” for details).

Note that, because *with-com-object* requires a COM object, it can only be used by the implementation of that object. All other code should use *with-com-interface* with the appropriate COM interface pointer.

**Example**

```lisp
(with-com-object (call-my-doc doc-impl) my-doc
  (call-my-doc move 0 0)
  (call-my-doc resize 100 200))
```

**See also**

- *call-com-object*
- *define-com-method*
- *with-com-interface*
**with-temp-interface**

*Macro*

**Summary**

Used to simplify reference counting for a COM interface pointer.

**Package**

com

**Signature**

```lisp
with-temp-interface (var) interface-ptr form* => values
```

**Arguments**

- `var`: A variable which is bound to `interface-ptr` while the `forms` are evaluated.
- `interface-ptr`: A form which is evaluated to yield a COM interface pointer.
- `form`: A form to be evaluated.

**Values**

- `values`: The values returned by the last `form`.

**Description**

When the macro `with-temp-interface` evaluates the `forms`, the variable `var` is bound to the value of `interface-ptr`. When control leaves the body (whether directly or due to a non-local exit), `release` is called with this interface pointer.

**Example**

This example invokes the COM method `GetDocumentation` in the interface `ITypeInfo` on an interface pointer which must be released after use.

```lisp
(defun get-tinfo-member-documentation (disp tinfo member-id)
  (with-temp-interface (typeinfo)
    (get-type-info disp tinfo)
    (call-com-interface (typeinfo i-type-info
      get-documentation)
      member-id))
)
```

**See also**

- `release`
- `with-query-interface`
with-query-interface  

Macro

Summary  Used to simplify reference counting when querying a COM interface pointer.

Package  com

Signature  

with-query-interface disp interface-ptr form* => values

disp ::= (punknown interface-name &key errorp dispatch)

Arguments  

punknown  A variable which is bound to the queried interface pointer while the forms are evaluated.

interface-name  A symbol which names the COM interface. It is not evaluated.

errorp  A boolean indicating whether an error should be signaled if interface-name is not implemented by interface-ptr.

dispatch  A symbol which will be defined as a local macro, as if by macrolet as if by with-com-interface. The macro can be used by the forms to invoke the methods on punknown.

interface-ptr  A form which is evaluated to yield a COM interface pointer to query.

form  A form to be evaluated.

Values  values  The values returned by the last form.

Description  

The macro with-query-interface calls query-interface to find an interface pointer for interface-name from the existing COM interface pointer interface-ptr. While evaluates the forms, the variable punknown is bound to the queried pointer and the pointer is released when control leaves the body (whether directly or due to a non-local exit).
If `errorp` is true, then `punknown` is bound to `nil` if the interface pointer cannot be found, otherwise an error of type `com-error` is signaled.

If `dispatch` is specified, then a local macro is created as if by `with-com-interface` to invoke COM interface methods on `punknown`.

Example

This example invokes the methods on an `i-bar` interface pointer queried from an existing interface pointer.

```lisp
(with-query-interface (p-bar i-bar :dispatch call-bar)
  p-foo
  (call-bar bar-init)
  (call-bar bar-print))
```

See also

- `query-interface`
- `release`
- `with-temp-interface`
2 COM Reference Entries
3

Using Automation

3.1 Including Automation in a Lisp application

This section describes how to load Automation and generate any FLI definitions needed to use it.

3.1.1 Loading the modules

Before using any of the LispWorks Automation APIs, you need to load the module using

(require "automation")

3.1.2 Generating FLI definitions from COM definitions

Automation components and interfaces that are to be used by the Automation API must be placed in a type library using suitable tools. In some cases, this type library will be supplied as part of the DLL or executable containing the component.

Some of the Automation APIs described in this chapter require you to convert the definitions in the type library into FLI definitions. This is done by compiling and loading a system definition that references the library with the options :type :midl-type-library-file. The names in the type library are
converted to Lisp symbols as specified in “The mapping from COM names to Lisp symbols” on page 3

**Note:** this is not required by all the APIs, for example see “Calling Automation methods without a type library” on page 92 and “A simple implementation of a single Automation interface” on page 97.

### 3.1.3 Reducing the size of the converted library

Suppose you have a `defsystem` system definition form that references a library: that is, a system member has options :type:`midl-type-library-file` as described in “Generating FLI definitions from COM definitions” on page 89.

For this member, the option :com can be added to specify whether all the COM functionality is required. The keyword can take these values:

- **t** Analyze and generate all the required code for calling and implementing the interfaces from the type library. This is the default value.
- **nil** Analyze but do not generate any code for calling or implementing COM interfaces from the type library. It is still possible to call Automation methods.
- **:not-binary** Analyze but do not generate any code for calling or implementing COM interfaces from the type library. It is still possible to call Automation methods and implement `dispinterfaces` in the type library, but not dual or COM interfaces.

Using the value **nil** or **:not-binary** generates much smaller code and is therefore much faster. However, it is never obligatory to use the option :com.

Use :com **nil** when the application calls Automation interfaces from the type library but does not implement any of them or need to call any methods from dual interfaces using `call-com-interface`.

Use :com **:not-binary** when the application implements only `dispinterfaces` from the library. This is typically required for implementing `sink` interfaces for use with connection points.
3.2 Starting a remote Automation server

For an example see

```
(example-edit-file "com/ole/simple-container/defsys")
```

### 3.2 Starting a remote Automation server

A remote Automation server is started from Lisp by using its coclass name, CLSID or ProgID. The macro `with-coclass` can be used to make an instance of an automation server from its coclass name for the duration of its body. The function `create-object` can be used to start an automation server given its CLSID or ProgID. The function `create-instance-with-events` can be used to start and automation server and set its event handler. The function `get-active-object` can be used to look for a registered running instance of a coclass in the system Running Object Table.

### 3.3 Calling Automation methods

Automation methods can be called either with or without a compiled type library. In both cases, arguments and return values are converted according to the types specified by the method’s definition.

#### 3.3.1 Calling Automation methods using a type library

To use this approach, you must have the type library available at compile-time (see “Generating FLI definitions from COM definitions” on page 89). Information from the type library is built into your application, which makes method calling more efficient. However, it also makes it less dynamic, because the library at the time the application is run must match.

There are three kinds of Automation method, each of which is called using macros designed for the purpose.

- Ordinary methods are called using the macros `call-dispatch-method` and `with-dispatch-interface`. If there is no Automation method with the given method name, then a property getter with the same name is called if it exists, otherwise an error is signaled. The `setf` form of `call-dispatch-method` can be used to call property setter methods.

- Property getter methods are called using the macro `call-dispatch-get-property`. 
• Property setter methods are called using the macros `call-dispatch-put-property` or the `setf` form of `call-dispatch-get-property`.

To use these macros, you need to specify the interface name, the method name, a COM interface pointer for the i-dispatch interface and suitable arguments. The interface and method names are given as symbols named as in Section 1.3 on page 3 and the COM interface pointer is a foreign pointer of type `com-interface`. In all the macros, the `args` and `values` are as specified in the Section 3.3.3.

The `with-dispatch-interface` macro is useful when several methods are being called with the same COM interface pointer, because it establishes a local macro that takes just the method name and arguments.

### 3.3.2 Calling Automation methods without a type library

This approach is useful if the type library is not available at compile time or you want to allow methods to be called dynamically without knowing the interface pointer type at compile-time. It can be less efficient than using the approach in Section 3.3.1, but is often the simplest approach, especially if the Automation component was written to be called from a language like Visual Basic.

There are three kinds of Automation method, each of which is called using functions designed for the purpose.

• Ordinary methods are called using the function `invoke-dispatch-method`. If there is no Automation method with the given method name, then a property getter with the same name is called if it exists, otherwise an error is signaled. The `setf` form of `invoke-dispatch-method` can be used to call property setter methods.

• Property getter methods are called using the function `invoke-dispatch-get-property`.

• Property setter methods are called either using the function `invoke-dispatch-put-property` or the `setf` form of `invoke-dispatch-get-property`.

To use these functions, you need to specify a COM interface pointer for the i-dispatch interface, the method name and suitable arguments. The method
name is given as a string or integer and the COM interface pointer is a foreign pointer of type `com-interface`. In all the functions, the `args` and `values` are as specified in the Section 3.3.3.

### 3.3.3 Data conversion when calling Automation methods

The arguments and return values to Automation methods are restricted to a small number of simple types, which map to Lisp types as follows:

<table>
<thead>
<tr>
<th>Automation type</th>
<th>VT code</th>
<th>Lisp type</th>
</tr>
</thead>
<tbody>
<tr>
<td>null value</td>
<td>VT_NULL</td>
<td>the symbol :null</td>
</tr>
<tr>
<td>empty value</td>
<td>VT_EMPTY</td>
<td>the symbol :empty</td>
</tr>
<tr>
<td>SHORT</td>
<td>VT_I2</td>
<td>integer</td>
</tr>
<tr>
<td>LONG</td>
<td>VT_I4</td>
<td>integer</td>
</tr>
<tr>
<td>FLOAT</td>
<td>VT_R4</td>
<td>single-float</td>
</tr>
<tr>
<td>DOUBLE</td>
<td>VT_R8</td>
<td>double-float</td>
</tr>
<tr>
<td>CY</td>
<td>VT_CY</td>
<td>not supported</td>
</tr>
<tr>
<td>DATE</td>
<td>VT_DATE</td>
<td>not supported</td>
</tr>
<tr>
<td>BSTR</td>
<td>VT_BSTR</td>
<td>string</td>
</tr>
<tr>
<td>IDispatch*</td>
<td>VT_DISPATCH</td>
<td>FLI (:pointer i-dispatch)</td>
</tr>
<tr>
<td>SCODE</td>
<td>VT_ERROR</td>
<td>integer</td>
</tr>
<tr>
<td>VARIANT_BOOL</td>
<td>VT_BOOL</td>
<td>nil or t</td>
</tr>
<tr>
<td>VARIANT*</td>
<td>VT_VARIANT</td>
<td>recursively convert</td>
</tr>
<tr>
<td>IUnknown*</td>
<td>VT_UNKNOWN</td>
<td>FLI (:pointer i-unknown)</td>
</tr>
<tr>
<td>DECIMAL</td>
<td>VT_DECIMAL</td>
<td>not supported</td>
</tr>
<tr>
<td>BYTE</td>
<td>VT_UI1</td>
<td>integer</td>
</tr>
<tr>
<td>SAFEARRAY</td>
<td>VT_ARRAY</td>
<td>array</td>
</tr>
<tr>
<td>dynamic</td>
<td>dynamic</td>
<td>lisp-variant</td>
</tr>
</tbody>
</table>

When an Automation argument is a `lisp-variant` object, its type is used to set the VT code. See `make-lisp-variant` and `set-variant`.

In and `in-out` parameters are passed as positional arguments in the calling forms and `out` and `in-out` parameters are returned as additional values. If there is an argument with the `retval` attribute then it is returned as the first value.
Optional parameters can be passed as `:not-specified` if they are not needed. Alternatively, they can be omitted if all remaining optional arguments are also omitted.

### 3.3.4 Using collections

The macro `do-collection-items` can be used to iterate over the items or an interface that implements the Collection protocol. If the collection items are interface pointers, they must be released when not needed.

For example, to iterate over the `Table` objects from the `Tables` collection of a `MyDocument` interface pointer

```lisp
(with-temp-interface (tables)
  (call-dispatch-get-property
   (doc my-document tables))
  (do-collection-items (table tables)
    (inspect-the-table table)
    (release table)))
```

### 3.3.5 Using connection points

Event sink interfaces can be connected and disconnected using the functions `interface-connect` and `interface-disconnect`.

For example, the following macro connects a sink interface pointer `event-handler` to a source of `i-clonable-events` events `clonable` for the duration of its body.
(defmacro handling-clonable-events ((clonable event-handler) &body body)
  (let ((cookie nil))
    (unwind-protect
      (progn
        (setq cookie (interface-connect clonable 'i-clonable-events ,event-handler))
        @body)
      (interface-disconnect ,clonable 'i-clonable-events ,cookie))))

3.3.6 Error handling
When an Automation server returns an error code, the calling macros such as call-dispatch-method signal an error of type com-error. The error message will contain the source and description fields from the error.

For example, if pp is a dispatch pointer to i-test-suite-1:

CL-USER 184 > (call-dispatch-method pp nil i-test-suite-1 fx)
"in fx" ;; implementation running
Error: COM IDispatch::Invoke Exception Occurred (0 "fx") : foo
1 (abort) Return to level 0.
2 Return to top loop level 0.

Type :b for backtrace, :c <option number> to proceed, or :? for other options

3.4 Implementing Automation interfaces in Lisp
This section describes two techniques for implementing Automation interfaces in Lisp. The choice of technique usually depends on whether you are implementing a complete server or a simple event sink. The section then describes other kinds of interfaces that can be implemented and how to report errors to the caller of a method.
3.4.1 A complete implementation of an Automation server

In the case where you are designing an set of COM interfaces and implementing a server to support them, you need to make a complete implementation in Lisp. This allows several Automation interfaces to be implemented by a single class and also supports dual interfaces.

The implementation defines an appropriate class, inheriting from the class standard-i-dispatch to obtain an implementation of the COM interface i-dispatch. This implementation of i-dispatch will automatically invoke the appropriate COM method.

For dual interfaces, the methods should be defined in the same way as described for COM interfaces in Section 1.8 on page 13.

For dispinterfaces, the methods should be implemented using the macro define-dispinterface-method or by a specialized method of the generic function com-object-dispinterface-involve.

To implement an Automation interface in Lisp with standard-i-dispatch, you need the following:

1. A type library for the component, converted to Lisp as specified in Section 3.1 on page 89.

2. A COM object class defined with define-automation-component or define-automation-collection, specifying the coclass or interface(s) to implement.


4. For an out-of-process Automation component, either use automation-server-main or have registration code which calls register-server and unregister-server, typically after checking the result of automation-server-command-line-action or explicitly checking the command line for arguments /RegServer and /UnRegServer.

5. Initialization code which either calls automation-server-top-loop or automation-server-main, or calls co-initialize and start-factories in a thread that will be processing Windows messages (for instance a CAPI thread).
3.4 Implementing Automation interfaces in Lisp

3.4.2 A simple implementation of a single Automation interface

In the case where you are implementing a single dispinterface that was designed by someone else, for example an event sink, you can usually avoid needing to parse a type library or define a class to implement the interface.

Instead, you implement a dispinterface using the class `simple-i-dispatch` by doing the following:

1. Obtain an interface pointer that will provide type information for the component, to be used as the `related-dispatch` argument in the call to the function `query-simple-i-dispatch-interface`. In the case where you are implementing an event sink, the source interface pointer will usually do this.

2. Optionally, define a class with `defclass` inheriting from `simple-i-dispatch`. The class `simple-i-dispatch` can be used itself if no special callback object is required.

3. Implement an `invoke-callback` that selects and implements the methods of the interface.

4. Define initialization code which calls `co-initialize`, obtains the `related-dispatch` from step 1, makes an instance of the COM object class defined in step 2 with the `invoke-callback` from step 3, obtains its interface pointer by calling `query-simple-i-dispatch-interface` (passing the `related-dispatch`) and attaches this interface pointer to the appropriate sink in the `related-dispatch` (for example using connection point functions such as `interface-connect`). This must all be done in a thread that will be processing Windows messages (for instance a CAPI thread).

3.4.3 Implementing collections

Interfaces that support the Collection protocol can be implemented using the macro `define-automation-collection`. This defines a subclass of `standard-automation-collection`, which implements the minimal set of collection methods and calls Lisp functions to provide the items. If the collection items are interface pointers, appropriate reference counting must be observed.

See the example files here:

```lisp
(exexample-edit-file "com/automation/collections/"
```
3.4.4 Implementing connection points

Lisp implementations can act as event sources via a built-in implementation of the IConnectionPointContainer interface, which define-automation-component provides if source interfaces are specified. A built-in implementation of IConnectionPoint handles connections for each interface and the macro do-connections can be used to iterate over the connections when firing the events.

3.4.5 Reporting errors

Classes defined using define-automation-component allow extended error information to be returned for all Automation methods. Within the body of a define-com-method definition, the function set-error-info can be called to describe the error. In addition, this function returns the value of DISP_E_EXCEPTION, which can be returned directly as the hresult from the method.

For example:

```
(define-com-method (i-test-suite-1 fx)
  ((this c-test-suite-1))
  (print "in fx")
  (set-error-info :description "foo"
                  :iid 'i-test-suite-1
                  :source "fx")
```

3.4.6 Registering a running object for use by other applications

If other applications need to be able to find one of your running objects from its coclass, then call register-active-object to register an interface pointer for the object in the system Running Object Table. Call revoke-active-object to remove the registration.

3.4.7 Automation of a CAPI application

For an example of how to implement an Automation server that controls a CAPI application, see the file:

```
(example-edit-file "com/automation/capi-application/build")
```
3.5 Examples of using Automation

Several complete examples are provided in the examples subdirectory of your LispWorks library.

A simple Automation application:

```lisp
(example-edit-file "com/automation/capi-application/readme.txt")
(example-edit-file "com/automation/cl-smtp/clsmtp-impl-build")
```

Controlling an Automation application:

```lisp
(example-edit-file "com/automation/capi-application/readme.txt")
(example-edit-file "com/automation/cl-smtp/clsmtp-test")
```

Getting events from COM interfaces:

```lisp
(example-edit-file "com/automation/events/ie-events")
(example-edit-file "com/automation/capi-application/readme.txt")
```
3 Using Automation
This chapter documents Automation functionality.

<table>
<thead>
<tr>
<th>com-dispatch-invoke-exception-error</th>
<th>Condition Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary</strong></td>
<td>The condition class used to signal Automation exceptions.</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>com</td>
</tr>
<tr>
<td><strong>Superclasses</strong></td>
<td>com-error</td>
</tr>
<tr>
<td><strong>Initargs</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>The class <code>com-dispatch-invoke-exception-error</code> is used by the LispWorks COM API when Automation signals an exception (<code>DISP_E_EXCEPTION</code>).</td>
</tr>
<tr>
<td><strong>See also</strong></td>
<td><code>com-dispatch-invoke-exception-error-info</code></td>
</tr>
</tbody>
</table>
**com-dispatch-invoke-exception-error-info**  
*Function*

<table>
<thead>
<tr>
<th>Summary</th>
<th>Retrieves information stored in a <code>com-dispatch-invoke-exception-error</code>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td><code>com</code></td>
</tr>
<tr>
<td>Signature</td>
<td><code>com-dispatch-invoke-exception-error-info condition fields =&gt; field-values</code></td>
</tr>
<tr>
<td>Arguments</td>
<td></td>
</tr>
<tr>
<td><code>condition</code></td>
<td>A <code>com-dispatch-invoke-exception-error</code>.</td>
</tr>
<tr>
<td><code>fields</code></td>
<td>A list of keywords as specified below.</td>
</tr>
<tr>
<td>Values</td>
<td></td>
</tr>
<tr>
<td><code>field-values</code></td>
<td>A list.</td>
</tr>
</tbody>
</table>
| Description | The function `com-dispatch-invoke-exception-error-info` retrieves information about the exception from a `com-dispatch-invoke-exception-error` object. The keywords in `fields` are used to select which information is returned in `field-values`, which is a list of values corresponding to each keyword in `fields`.

The following keyword are supported in `fields`:

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>:code</code></td>
<td>The error code.</td>
</tr>
<tr>
<td><code>:source</code></td>
<td>The source of the error.</td>
</tr>
<tr>
<td><code>:description</code></td>
<td>The description of the error.</td>
</tr>
<tr>
<td><code>:help-file</code></td>
<td>The help file for the error.</td>
</tr>
<tr>
<td><code>:help-context</code></td>
<td>The help context for the error.</td>
</tr>
</tbody>
</table>
Example

```
(handler-case
  (com:invoke-dispatch-method counter "Run")
  (com:com-dispatch-invoke-exception-error (condition)
    (destructuring-bind (code description)
      (com:com-dispatch-invoke-exception-error-info
        condition
        '(:code :description))
      (format *error-output*
        "Run failed with code ~D, description ~S."
        code
description))))
```

See also com-dispatch-invoke-exception-error

call-dispatch-get-property

Macro

Summary

Calls an Automation property getter method from a particular interface.

Package  com

Signature

```
call-dispatch-get-property spec arg* => values

spec ::= (dispinterface-ptr dispinterface-name method-name)
```

Arguments

`spec` The interface pointer and a specification of the method to be called.

`dispinterface-ptr` A form which is evaluated to yield a COM `i-dispatch` interface pointer.

`dispinterface-name`  A symbol which names the Automation interface. It is not evaluated.

`method-name`  A symbol which names the property getter method. It is not evaluated.

`arg`  Arguments to the method (see Section 3.3.3, "Data conversion when calling Automation methods" for details).
Values

**values**

Values from the method (see Section 3.3.3, “Data conversion when calling Automation methods” for details).

Description

The **call-dispatch-get-property** macro is used to invoke an Automation property getter method from Lisp. The **dispinterface-ptr** should be a COM interface pointer for the **i-dispatch** interface. The appropriate Automation property getter method, chosen using **dispinterface-name** and **method-name**, is invoked after evaluating each **arg**. The **args** must be values that are suitable for the method and of types compatible with Automation. The values returned are as specified by the method signature. In general, property getter methods take no arguments and return the value of the property, but see Section 3.3.3, “Data conversion when calling Automation methods” for more details.

There is also **setf** expander for **call-dispatch-get-property**, which can be used as an alternative to the **call-dispatch-put-property** macro.

Example

For example, in order to get and set the **Width** property of a **MyDocument** interface pointer

```
(call-dispatch-get-property
 (doc my-document width))

(setf (call-dispatch-get-property
 (doc my-document width))
  10)
```

See also

**call-dispatch-put-property**
**call-dispatch-method**

---

**call-dispatch-method**

**Macro**

**Summary**

Calls an Automation method from a particular interface.
Package: com

Signature:
call-dispatch-method spec arg* => values

spec ::= (dispinterface-ptr dispinterface-name method-name)

Arguments:
spec The interface pointer and a specification of the method to be called.
dispinterface-ptr A form which is evaluated to yield a COM i-dispatch interface pointer.
dispinterface-name A symbol which names the Automation interface. It is not evaluated.
method-name A symbol which names the method. It is not evaluated.
arg Arguments to the method (see Section 3.3.3, "Data conversion when calling Automation methods" for details).

Values:
values Values from the method (see Section 3.3.3, "Data conversion when calling Automation methods" for details).

Description: The call-dispatch-method macro is used to invoke an Automation method from Lisp. The dispinterface-ptr should be a COM interface pointer for the i-dispatch interface. The appropriate Automation method, chosen using dispinterface-name and method-name, is invoked after evaluating each arg. The args must be values that are suitable for the method and of types compatible with Automation. The values returned are as specified by the method signature. See Section 3.3.3, "Data conversion when calling Automation methods" for more details. If there is no Automation method with the given method-name, then a property getter with the same name is called if it exists, otherwise an error is signaled. The
**setf** form of `call-dispatch-method` can be used to call property setter methods.

**Example**

For example, in order to invoke the `ReFormat` method of a `MyDocument` interface pointer

```lisp
(call-dispatch-method (doc my-document re-format))
```

**See also**

`with-dispatch-interface`

`call-dispatch-get-property`

`call-dispatch-put-property`

---

**call-dispatch-put-property**

*Macro*

**Summary**

Calls an Automation property setter method from a particular interface.

**Package**

`com`

**Signature**

`call-dispatch-put-property spec arg* => values`

```
spec ::= (dispinterface-ptr dispinterface-name method-name)
```

**Arguments**

- `spec` The interface pointer and a specification of the method to be called.
- `dispinterface-ptr` A form which is evaluated to yield a COM `i-dispatch` interface pointer.
- `dispinterface-name` A symbol which names the Automation interface. It is not evaluated.
- `method-name` A symbol which names the property getter method. It is not evaluated.
- `arg` Arguments to the method (see Section 3.3.3, “Data conversion when calling Automation methods” for details).
Values

values

Values from the method (see Section 3.3.3, “Data conversion when calling Automation methods” for details).

Description

The call-dispatch-put-property macro is used to invoke an Automation property setter method from Lisp. The dispatch-ptr should be a COM interface pointer for the i-dispatch interface. The appropriate Automation property setter method, chosen using dispinterface-name and method-name, is invoked after evaluating each arg. The args must be values that are suitable for the method and of types compatible with Automation. The values returned are as specified by the method signature. In general, property setter methods take one argument (the new value) and return the no values, but see Section 3.3.3, “Data conversion when calling Automation methods” for more details.

There is also setf expander for call-dispatch-get-property, which can be used as an alternative to the call-dispatch-put-property macro.

Example

For example, in order to set the Width property of a MyDocument interface pointer

(call-dispatch-put-property
  (doc my-document width)
  10)

See also

call-dispatch-get-property
call-dispatch-method

com-object-dispinterface-invokes

Generic Function

Summary

A generic function called by IDispatch::Invoke when there is no defined dispinterface method.

Package

com
4 Automation Reference Entries

Signature

| com-object-dispinterface-invoke | com-object | method-name | method-type | args | => | value |

Arguments

- com-object: A COM object whose method is being invoked.
- method-name: A string naming the method to be called.
- method-type: A keyword specifying the type of method being called.
- args: A vector containing the arguments to the method.

Description

The generic function `com-object-dispinterface-invoke` is called by `IDispatch::Invoke` when there is no method defined using `define-dispinterface-method`.

Methods can be written for `com-object-dispinterface-invoke`, specializing on an Automation implementation class and implementing the method dispatch based on `method-name` and `method-type`.

The `method-name` argument is a string specifying the name of the method as given by the method declaration in the IDL or type library. The `method-type` argument, has one of the following values:

- (:get) when invoking a property getter method.
- (:put) when invoking a property setter method.
- (:method) when invoking a normal method.

The arguments to the method are contained in the vector `args`, in the order specified by the method declaration in the type library. For `in` and `in-out` arguments, the corresponding element of `args` contains the argument value converted to the type specified by the method declaration and then converted to Lisp objects as specified in Section 3.3.3, “Data conversion when calling Automation methods”. For `out` and `in-out` arguments, the corresponding element of `args` should be set by the
method to contain the value to be returned to the caller and
will be converted to an automation value as specified in
Section 3.3.3, “Data conversion when calling Automation
methods”.

The value should be a value which can be converted to the
appropriate return type as the primary value of the method
and will be converted to an automation value as specified in
Section 3.3.3, “Data conversion when calling Automation
methods”. It is ignored for methods that are declared as
returning void.

Notes
When using com-object-dispinterface-invoke, it is not
possible to distinguish between invocations of the same
method name for different interfaces when com-object imple-
ments several interfaces. If this is required, then the method
must be defined with define-dispinterface-method.

Example
(example-edit-file
"com/ole/simple-container/owc-spreadsheet")

See also define-dispinterface-method

create-instance-with-events

Function

Summary
A convenience function which combines create-instance
and set-i-dispatch-event-handler.

Package com

Signature
create-instance-with-events clsid event-handler &rest args
&key event-object => interface, list

Arguments
clsid A string or a guid giving a CLSID to cre-
ate.

event-handler A function of four arguments.
4 Automation Reference Entries

**event-object**

A Lisp object.

**Values**

**interface**

An *i-dispatch* interface.

**sinks**

A list of objects representing the connections made.

**Description**

The function `create-instance-with-events` is a convenience function which starts an *i-dispatch* interface and sets an event handler.

It first calls `create-instance` with `clsid` and all the keyword arguments except the `event-object`. It defaults the `create-instance` argument `riid` to the value `i-dispatch`.

It then calls `set-i-dispatch-event-handler` on the resulting interface, passing `event-handler`, `event-object` and `clsid` (as the coclass).

`interface` is the interface started, and `sinks` is the result of `set-i-dispatch-event-handler`.

**Examples**

```
(exexample-edit-file "com/automation/events/ie-events")
```

**See also**

`create-instance`

`set-i-dispatch-event-handler`

---

**create-object**

**Function**

**Summary**

Create an instance of a coclass.

**Package**

`com`

**Signature**

`create-object &key clsid progid clsctx => interface-ptr`

**Arguments**

`clsid` A string giving a CLSID to create.

`progid` A string giving a ProgID to create.
A CLSCTX value, which defaults to CLSCTX_SERVER.

An i-dispatch interface pointer.

Creates an instance of a coclass and returns its i-dispatch interface pointer. The coclass can be specified directly by using the clsid argument or indirectly using the progid argument, which will locate the CLSID from the registry.

The following are equivalent ways of creating an Microsoft Word application object:

(create-object :progid "Word.Application.8")

(create-object :clsid "000209FF-0000-0000-C000-000000000046")

See also with-coclass

**define-automation-collection**

Defines an implementation class for an Automation component that supports the Collection protocol.

**Signature**

define-automation-collection class-name (superclass-name*) (slot-specifier*) class-option*

**Arguments**

- **class-name** A symbol naming the class to define.
- **superclass-name** A symbol naming a superclass to inherit from.
- **slot-specifier** A slot description as used by defclass.
- **class-option** An option as used by defclass.
The macro define-automation-collection defines a standard-class which is used to implement an Automation component that supports the Collection protocol. Normal defclass inheritance rules apply for slots and Lisp methods.

Each superclass-name argument specifies a direct superclass of the new class, which can be any standard-class provided that standard-automation-collection is included somewhere in the overall class precedence list. This standard class provides a framework for the collection class.

slot-specifiers are standard defclass slot definitions.

class-options are standard defclass options. In addition the following options are recognized:

(:interface interface-name)

This option is required. The component will implement the interface-name, which must be an Automation Collection interface, containing (at least) the standard properties Count and _NewEnum. The macro will define an implementation of these methods using information from the instance of the class to count and iterate.

(:item-method item-method-name*)

When specified, a COM method named item-method-name will be defined that will look up items using the item-lookup-function from the instance. If not specified, the method will be called Item. For Collections which do not have an item method, pass nil as the item-method-name.

Example
See also  
define-automation-component  
standard-automation-collection  

**define-automation-component**  
*Macro*

**Summary**  Define an implementation class for a particular Automation component.

**Package**  
com

**Signature**  
define-automation-component class-name (superclass-name*)  
(slot-specifier*)  class-option*

**Arguments**  
class-name  A symbol naming the class to define.  
superclass-name  A symbol naming a superclass to inherit from.  
slot-specifier  A slot description as used by defclass.  
class-option  An option as used by defclass.

**Description**  
The macro define-automation-component defines a standard-class which is used to implement an Automation component. Normal defclass inheritance rules apply for slots and Lisp methods.

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 available:

- standard-i-dispatch is always needed and provides a complete implementation of the i-dispatch interface, based on the type information in the type library.
- **standard-i-connection-point-container** is needed if there are any source interfaces specified (via the 
  :**coclasse** or :**source-interfaces** options). This provides a complete implementation of the Connection 
  Point protocols.

*slot-specifiers* are standard defclass slot definitions.

*class-options* are standard defclass options. In addition the 
following options are recognized:

1. (**coclasse** **coclasse-name**)  
   - **coclasse-name** is a symbol specifying the name 
     of a coclass. If this option is specified then a 
     class factory will be registered for this 
     coclass, to create an instance of **class-name** 
     when another application requires it. The 
     component will implement the interfaces 
     specified in the coclass definition and the 
     default interface will be returned by the 
     class factory.
   
   Exactly one of **coclasse** and **interfaces** must be specified.

2. (**interfaces** **interface-name**)  
   - Each **interface-name** specifies an Automation 
     interface that the object will implement. The 
     i-unknown and i-dispatch interfaces 
     should not be specified because their imple-
     mentations are automatically inherited from 
     standard-i-dispatch. No class factory 
     will be registered for **class-name**, so the only 
     way to make instances is from with Lisp by 
     calling make-instance.
   
   Exactly one of **coclasse** and **interfaces** must be specified.
(:\source-interfaces\ interface-name*)

Each interface-name specifies a source interface on which the object allows connections to be made. If the :\coclass\ option is also specified, then the interfaces flagged with the source attribute are used as the default for the :source-interfaces option.

When there are event interfaces, the component automatically implements the IConnectionPointContainer interface. The supporting interfaces IEnumConnectionPoints, IConnectionPoint and IEnumConnections are also provided automatically.

(:\extra-interfaces\ interface-name*)

Each interface-name specifies a COM interface that the object will implement, in addition to the interfaces implied by the :\coclass\ option. This allows the object to implement other interfaces not mentioned in the type library.

(:\coclass-reusable-p\ reusable)

If reusable is true (the default), then the server running the component can receive requests from more than one application. If reusable is nil, then the server will receive requests only from the application that started it and the Operating System will start a new instance of the server if required. For more details, see REGCLS_MULTIPLEUSE and REGCLS_SINGLEUSE in MSDN.
(:type-library type-library-name)

type-library-name is a symbol specifying the name of a type library, mapped from the name given by the "library" statement in the IDL. If this option is specified then an error is signaled if the names used in the :coclass, :interfaces or :source-interfaces class options are not defined by type-library-name.

Use define-com-method, define-dispinterface-method or com-object-dispinterface-invoke to define methods in the interfaces implemented by the component. See also Section 1.8.4, “Unimplemented methods”.

Example

(define-automation-component c-test-suite-1 ()
  ((prop3 :initform nil)
   (interface-4-called :initform nil))
  (:coclass test-suite-component)
)

See also

define-com-method
define-dispinterface-method
com-object-dispinterface-invoke
standard-i-dispatch
standard-i-connection-point-container
define-automation-collection

define-dispinterface-method  

Macro

Summary

The define-dispinterface-method macro is used to define a dispinterface method.

Package  

com

Signature

define-dispinterface-method method-spec (class-spec . lambda-list) form* => value
\[ \text{method-spec ::= method-name} \mid (\text{interface-name method-name}) \]

\[ \text{class-spec ::= (this class-name)} \]

**Arguments**

<table>
<thead>
<tr>
<th>element</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>method-spec</td>
<td>Specifies the method to be defined.</td>
</tr>
<tr>
<td>method-name</td>
<td>A symbol naming the method to define.</td>
</tr>
<tr>
<td>interface-name</td>
<td>A symbol naming the interface of the method to define. This is only required if the implementation class class-name has more than one method with the given method-name.</td>
</tr>
<tr>
<td>class-spec</td>
<td>Specifies the implementation class and variables bound to the object with in the forms.</td>
</tr>
<tr>
<td>this</td>
<td>A symbol which will be bound to the COM object whose method is being invoked.</td>
</tr>
<tr>
<td>class-name</td>
<td>A symbol naming the COM implementation class for which this method is defined.</td>
</tr>
<tr>
<td>lambda-list</td>
<td>A simple lambda list. That is, a list of parameter names.</td>
</tr>
<tr>
<td>form</td>
<td>Forms which implement the method. The value of the final form is returned as the result of the method.</td>
</tr>
<tr>
<td>value</td>
<td>The value to be returned to the caller.</td>
</tr>
</tbody>
</table>

**Description**

The macro `define-dispinterface-method` defines a dispinterface method that implements the method `method-name` for the Automation implementation class `class-name`. The extended `method-spec` syntax is required if `class-name` implements more than one interface with a method called `method-name` (analogous to the C++ syntax `InterfaceName::MethodName`).

The symbol `this` is bound to the instance of the Automation implementation class on which the method is being invoked.
The number of parameter in lambda-list must match the declaration in the type library. Each in and in-out parameter is bound to the value passed to IDispatch::Invoke, converted to the type specified by the method declaration and then converted to Lisp objects as specified in Section 3.3.3, “Data conversion when calling Automation methods”. For missing values the value of the parameter is :not-found. For out and in-out arguments, the corresponding parameter should be set by the forms to contain the value to be returned to the caller and will be converted to an automation value as specified in Section 3.3.3, “Data conversion when calling Automation methods”.

The value should be a value which can be converted to the appropriate return type as the primary value of the method and will be converted to an automation value as specified in Section 3.3.3, “Data conversion when calling Automation methods”. It is ignored for methods that are declared as returning void.

Notes

The define-com-method macro should be used to implement methods in dual interfaces.

See also

define-com-method
com-object-dispinterface-invoker

disconnect-standard-sink

Function

Summary

Releases a standard sink object, stopping the events.

Package

com

Signature
disconnect-standard-sink sink => result

Arguments

sink A standard sink object.

Values

result t or nil.
The function `disconnect-standard-sink` releases a standard sink object. This is one of the objects in the list returned by `set-i-dispatch-event-handler` which represents a connection it made.

`disconnect-standard-sink` stops the events that pass through `sink`.

`result` is `t` if the sink was released.

See also `create-instance-with-events`  
`set-i-dispatch-event-handler`

### do-collection-items

**Macro**

**Summary**
Iterates over the items of an Automation Collection.

**Package**
`com`

**Signature**
`do-collection-items (item collection) form*`

**Arguments**
- `item` A symbol bound to each item in the collection in turn.
- `collection` A form which is evaluated to yield a COM `i-dispatch` interface pointer that implements the collection protocol.
- `form` A form to be evaluated.

**Description**
The `do-collection-items` macro executes each `form` in turn, with `item` bound to each item of the `collection`.

Note that for collections whose items are interface pointers, the `forms` must arrange for each pointer to be released when no longer needed. The `collection` should be a COM interface pointer for an `i-dispatch` interface that implements the Collection protocol. The items are converted to Lisp as specified
in Section 3.3.3, “Data conversion when calling Automation methods”.

Example

For example, to iterate over the Table objects from the Tables collection of a MyDocument interface pointer

(with-temp-interface (tables)
  (call-dispatch-get-property
   (doc my-document tables))
  (do-collection-items (table tables)
   (inspect-the-table table)
   (release table)))

See also call-dispatch-method

**do-connections**

*Macro*

**Summary**

Iterates over the sinks for a given Automation component object.

**Package**

com

**Signature**

do-connections ((sink interface-name &key dispatch automation-dispatch) container) form*

**Arguments**

- *sink* A symbol which will be bound to each sink interface pointer.
- *interface-name* A symbol naming the sink interface.
- *dispatch* A symbol which will be bound to a local macro that invokes a method from the sink interface as if by with-com-interface.
- *automation-dispatch* A symbol which will be bound to a local macro that invokes a method from the sink interface as if by with-dispatch-interface.
container  An instance of a component class that has
interface-name as one of its source interfaces.

form    A form to be evaluated.

Description
The macro do-connections provides a way to iterate over
all the sink interface pointers for the source interface
interface-name in the connection point container container. The
container must be a subclass of
standard-i-connection-point-container. Each form is
evaluated in turn with sink bound to each interface pointer. If
dispatch is given, it is defined as a local macro invoking the
COM interface interface-name as if by with-com-interface.
If automation-dispatch is given, it is defined as a local macro
invoking the Automation interface interface-name as if by
with-dispatch-interface.

Within the scope of do-connections you can call the local
function discard-connection which discards the connec-
tion currently bound to sink. This is useful when an error is
detected on that connection, for example when the client has
terminated. The signature of this local function is

discard-connection &key release
release is a boolean defaulting to false. If release is true then
release is called on sink.

Example
Suppose there is a source interface i-clonable-events with
a method on-cloned. The following function can be used to
invoke this method on all the sinks of an instance of a
clonable-component class:

(defun fire-on-cloned (clonable-component)
  (do-connections ((sink i-clonable-events
                    :dispatch call-clonable)
                   clonable-component)
    (call-clonable on-cloned value)))
find-component-tlb

**Function**

**Summary**
Returns the path of the type library associated with a component name.

**Package**
com

**Signature**
```
find-component-tlb name &key version min-version max-version => path
```

**Arguments**
- `name` A string.
- `version` A string or nil.
- `min-version` A string or nil.
- `max-version` A string or nil.

**Values**
- `path` A string or nil.

**Description**
The function `find-component-tlb` returns the path of the type library associated with the component `name`.

`name` should be the name of a component (either a ProgID or a GUID).

If `version` is supplied, `find-component-tlb` finds only this version of the type library.

If `min-version` or `max-version`, or both of these, are supplied, they restrict which version of the type library can be found.

Each of `version`, `min-version` and `max-version`, if supplied, should be a string. The string should contain either one hexadecimal number or two hexadecimal numbers separated by a
The first number is the major version, the second is the minor version, which defaults to 0.

If `version` is not supplied, then `find-component-tlb` preferentially finds the library version specified in the registry for the component (if any) if it fits the specification by `max-version` and/or `min-version`, otherwise it finds the earliest version in the range specified by `min-version` and `max-version`.

`find-component-tlb` returns `nil` if it fails to find the type library within the specified version constraints.

See also `:midl-type-library-file`
:library Returns the library that implements the component (if any)

:inproc-server32
As for :library

:local-server32
Returns the executable that implements the component (if any)

:version Returns the version

:prog-id Returns the ProgID

:version-independent-prog-id
Returns the version-independent ProgId

:type-lib Returns the GUID of the type library

find-component-value returns the value result associated with the given key-name in the registry for component name. If a value is found, then there is a second returned value root which is either :local-machine or :user, indicating the branch of the registry in which the value was found.

find-component-value simply returns nil if it fails to find the information.

When running on 64-bit Windows, 32-bit LispWorks looks in the 32-bit registry view and 64-bit LispWorks looks in the 64-bit registry view. LispWorks does not change the registry reflection settings.

Examples
(com:find-component-value "shell.explorer" :version)

get-active-object

Function

Summary
Looks for a registered running instance of a coclass.

Signature
get-active-object &key clsid progid riid errorp => interface-ptr
**Arguments**

- **clsid**: A string or a refguid giving a CLSID to create.
- **progid**: A string giving a ProgID to create.
- **riid**: An optional refiid giving the COM interface name to return.
- **errorp**: A boolean. The default is t.

**Values**

- **interface-ptr**: A COM interface pointer for riid.

**Description**

Looks for a registered running instance of a coclass in the system Running Object Table and returns its riid interface pointer if any. If riid is nil, then i-unknown is used.

The coclass can be specified directly by using the clsid argument or indirectly using the progid argument, which will locate the CLSID from the registry.

If errorp is true, then an error is signalled if no instances are running. Otherwise nil is returned if no instances are running.

**Example**

```lisp
(get-active-object :progid "Excel.Application" :riid 'i-dispatch)
```

**See also**

- get-object

---

**get-error-info**

**Function**

**Summary**

Retrieves the error information for the current Automation method.

**Package**

com

**Signature**

```lisp
get-error-info &key errorp fields => field-value*
```
Arguments

errorp
A boolean. If true and an error occurs while retrieving the error information, then an error of type com-error is signaled. Otherwise nil is returned.

fields
A list of keywords specifying the error information fields to return.

Values

field-value*
Values corresponding to the fields argument.

Description

The function get-error-info allows the various components of the error information to be retrieved for the last Automation method called. The fields should be a list of the following keywords, to specify which fields of the error information should be returned:

:iid
A refguid object.

:source
A string specifying the ProgID.

:description
A string describing the error.

:help-file
A string giving the help file’s path.

:help-context
An integer giving the help context id.

A field-value will be returned for each field specified. The field-value will be nil if the field is does not have a value.

Example

(multiple-value-bind (source description)  
  (get-error-info :fields '(:source :description))  
  (error "Failed with 'A' in 'A' description source))

See also

set-error-info

call-dispatch-method

com-error

get-i-dispatch-name

Function

Summary

Returns the foreign name of an i-dispatch interface.
get-i-dispatch-name

**Package**
com

**Signature**
get-i-dispatch-name  
i-dispatch => name

**Arguments**
i-dispatch  
An i-dispatch interface.

**Values**
name  
A string.

**Description**
The function get-i-dispatch-name returns the foreign name of an i-dispatch interface. That is, it obtains the first return value of ITypeInfo::GetDocumentation.

**Example**
To implement code like this:

```lisp
If TypeOf objMap.Selection Is Pushpin Then
...
```
you would need something like:

```lisp
(if (equalp (com:get-i-dispatch-name selection) "PushPin")
  ...)
```

**See also**
print-i-dispatch-methods
i-dispatch
create-object
create-instance-with-events
“Starting a remote Automation server” on page 91

---

get-i-dispatch-source-names

**Function**

**Summary**
Returns the source names associated with an i-dispatch interface.

**Package**
com

**Signature**
get-i-dispatch-source-names  
i-dispatch &key all coclass => source-names
Arguments

- \textit{i-dispatch}  
  An \textit{i-dispatch} interface.

- \textit{all}  
  A generalized boolean, default value false.

- \textit{coclass}  
  The coclass to use, or \texttt{nil}.

Values

- \textit{source-names}  
  A list.

Description

The function \texttt{get-i-dispatch-source-names} returns the source names that are associated with the \textit{i-dispatch} interface \textit{i-dispatch}, which will be used by \texttt{set-i-dispatch-event-handler}.

\textit{coclass} and \textit{all} are as described for \texttt{set-i-dispatch-event-handler}.

Notes

If you need to call \texttt{set-i-dispatch-event-handler} repeatedly, then it is most efficient to call \texttt{get-i-dispatch-source-names} once and pass the result \textit{source-names} to \texttt{set-i-dispatch-event-handler}. This is because \texttt{set-i-dispatch-event-handler} itself calls \texttt{get-i-dispatch-source-names} if its \textit{source-names} argument is \texttt{nil}.

See also \texttt{set-i-dispatch-event-handler}

\textbf{\textit{i-dispatch}}  
\textit{COM Interface Type}

Summary

The Lisp name for the \textit{i-dispatch} COM interface.

Package

\texttt{com}

Description

The symbol \texttt{i-dispatch} is the name given to the \textit{i-dispatch} COM interface within Lisp. The name results from the standard mapping described in Section 1.3, “The mapping from COM names to Lisp symbols”.
interface-connect  

Function

Summary
Connects a sink interface pointer to the source of events in another COM interface pointer.

Package  com

Signature
\texttt{interface-connect \ interface-ptr iid sink-ptr \&key errorp => cookie}

Arguments
\begin{itemize}
  \item \texttt{interface-ptr} A COM interface pointer that provides the source interface \texttt{iid}.
  \item \texttt{iid} The iid of the source interface to be connected. The iid can be a symbol naming the interface or a \texttt{refguid} foreign pointer.
  \item \texttt{sink-ptr} A COM interface that will receive the events for the \texttt{iid}.
  \item \texttt{errorp} A boolean. When false, errors connecting the \texttt{sink-ptr} will cause \texttt{nil} to be returned. Otherwise an error of type \texttt{com-error} will be signaled.
\end{itemize}

Values
\begin{itemize}
  \item \texttt{cookie} An integer cookie associated with this connection.
\end{itemize}

Description
Connects the COM interface \texttt{sink-ptr} to the connection point in \texttt{interface-ptr} that is named by \texttt{iid}.

Example
Suppose there is an interface pointer \texttt{clonable} which provides a source interface \texttt{i-clonable-events}, then the fol-
lowing form can be used to connect an implementation of this source interface `sink`:

```lisp
(setq cookie
  (interface-connect clonable
    'i-clonable-events
    sink))
```

See also `interface-disconnect`
`refguid`
`com-error`

---

**interface-disconnect**

*Function*

**Summary**
Disconnected a sink interface pointer from the source of events in another COM interface pointer.

**Package**
`com`

**Signature**

```lisp
interface-disconnect &key interface-ptr iid cookie &key errorp => flag
```

**Arguments**

- `interface-ptr`: A COM interface pointer that provides the source interface `iid`.
- `iid`: The iid of the source interface to be disconnected. The iid can be a symbol naming the interface or a `refguid` foreign pointer.
- `cookie`: The integer cookie associated with the connection to be disconnected.
- `errorp`: A boolean. When false, errors disconnecting the `cookie` will cause `nil` to be returned. Otherwise an error of type `com-error` will be signaled.

**Values**

- `flag`: A boolean, true for successful disconnection.
Description
Disconnects the connection for cookie from the connection point in interface-ptr that matches iid.

Example
Suppose there is an interface pointer clonable which provides a source interface i-clonable-events, then the following form can be used to disconnect an implementation of this source interface with cookie cookie:

(interface-disconnect clonable 'i-clonable-events cookie)

See also
interface-connect
refguid
com-error

lisp-variant

Summary
An object that contains a type and a value.

Package
com

Accessors
lisp-variant-type
lisp-variant-value

Description
A lisp-variant is an object that contains a type and a value. The type and value are as described for the function set-variant.

See also
make-lisp-variant
set-variant

invoke-dispatch-get-property

Summary
Call a dispatch property getter method from an interface pointer.
Package: `com`

Signature: `invoke-dispatch-get-property dispinterface-ptr name &rest args => values`

Arguments:
- `dispinterface-ptr`: An Automation interface pointer.
- `name`: A string or integer.
- `args`: Arguments passed to the method.

Values: `values` Values returned by the method.

Description: The function `invoke-dispatch-get-property` is used to invoke an Automation property getter method from Lisp without needing to compile a type library as part of the application. This is similar to using

```lisp
Dim var as Object
Print #output, var.Prop
```

in Microsoft Visual Basic and contrasts with the macro `call-dispatch-get-property` which requires a type library to be compiled.

The `dispinterface-ptr` should be a COM interface pointer for the `i-dispatch` interface. The appropriate Automation method, chosen using `name`, which is either a string naming the method or the integer id of the method. The `args` are converted to Automation values and are passed as the method’s `in` and `in-out` parameters in the order in which they appear. The `values` returned consist of the primary value of the method (if not void) and the values of any `out` or `in-out` parameters. See Section 3.3.3, “Data conversion when calling Automation methods” for more details.

There is also `setf` expander for

`invoke-dispatch-get-property`, which can be used as an alternative to the `call-dispatch-put-property` macro.
Example

For example, in order to get and set the `Width` property of an interface pointer in the variable `doc`:

```lisp
(invoke-dispatch-get-property doc "Width")

(setf (invoke-dispatch-get-property doc "Width") 10)
```

See also

- `invoke-dispatch-method`
- `invoke-dispatch-put-property`
- `call-dispatch-get-property`

---

**invoke-dispatch-method**

*Function*

**Summary**

Call a dispatch method from an interface pointer.

**Package**

`com`

**Signature**

```
invoke-dispatch-method dispinterface-ptr name &rest args => values
```

**Arguments**

- `dispinterface-ptr` An Automation interface pointer.
- `name` A string or integer.
- `args` Arguments passed to the method.

**Values**

- `values` Values returned by the method.

**Description**

The function `invoke-dispatch-method` is used to invoke an Automation method from Lisp without needing to compile a type library as part of the application. This is similar to using

```vbnet
Dim var as Object
var.Method(1,2)
```

in Microsoft Visual Basic and contrasts with the macro `call-dispatch-method` which requires a type library to be compiled.
The `dispinterface-ptr` should be a COM interface pointer for the `i-dispatch` interface. The appropriate Automation method, chosen using `name`, which is either a string naming the method or the integer id of the method. The `args` are converted to Automation values and are passed as the method’s `in` and `in-out` parameters in the order in which they appear. The `values` returned consist of the primary value of the method (if not void) and the values of any `out` or `in-out` parameters. See Section 3.3.3, “Data conversion when calling Automation methods” for more details. If there is no Automation method with the given name, then a property getter with the same name is called if it exists, otherwise an error is signaled. The `setf` form of `invoke-dispatch-method` can be used to call property setter methods.

**Example**

For example, in order to invoke the `ReFormat` method of an interface pointer in the variable `doc`:

```lisp
(invoke-dispatch-method doc "ReFormat")
```

**See also**

- `invoke-dispatch-get-property`
- `invoke-dispatch-put-property`
- `call-dispatch-method`
The function `invoke-dispatch-put-property` is used to invoke an Automation property setter method from Lisp without needing to compile a type library as part of the application. This is similar to using

```
Dim var as Object
var.Prop = 2
```

in Microsoft Visual Basic and contrasts with the macro `call-dispatch-put-property` which requires a type library to be compiled.

The `dispinterface-ptr` should be a COM interface pointer for the `i-dispatch` interface. The appropriate Automation method, chosen using `name`, which is either a string naming the method or the integer id of the method. The `args` are converted to Automation values and are passed as the method’s `in` and `in-out` parameters in the order in which they appear.

The new value of the property should be the last argument. The `values` returned consist of the primary value of the method (if not void) and the values of any `out` or `in-out` parameters. See Section 3.3.3, “Data conversion when calling Automation methods” for more details.

**Example**

For example, in order to set the `Width` property of an interface pointer in the variable `doc`:

```
(invoke-dispatch-put-property doc "Width" 10)
```

**See also**

`invoke-dispatch-method`

`invoke-dispatch-get-property`

`call-dispatch-put-property`
make-lisp-variant

Function

Summary
Returns a Lisp object that contains a type and a value.

Package
com

Signature
make-lisp-variant type &optional value => lisp-variant

Description
The function `make-lisp-variant` returns a `lisp-variant` object `lisp-variant` containing `type` and `value`. `lisp-variant` can be passed as an argument to an Automation method, to give control over the VT code that the method sees. The meaning of `type` and `value` are as described for `set-variant`.

See also
lisp-variant
set-variant

:midl-type-library-file

Defsystem Member Type

Summary
A defsystem member type that can be used to include a type library file in a Lisp system definition.

Package
com

Description
When a file is given the type :midl-type-library-file, compiling the system will compile the type library file to produce a fasl. Loading the system will load this fasl. The :package and :mapping-options keywords can specified as for midl.

The keyword :component-name `name-spec` can be supplied to specify that the source is the library specified by `name-spec`. `name-spec` should be one of:
t Means that the component name is the same as the module name.

A string The name of the component.

A list (component-name keywords-and-values) where the keywords and values are passed to find-component-tlb when looking for the actual library.

In all cases the module name, less anything after the last dot, is used as the default filename for the compiled file.

The keyword :com can be supplied to reduce the amount of code generated. For the details, see “Reducing the size of the converted library” on page 90.

Examples

To include the file myfile.tlb in a system, use

(defsystem my-system ()
  :members (("myfile.tlb"
    :type :midl-type-library-file)))

To compile the library associated with "OWC10.Spreadsheets", producing an object file in OWC10.ofasl put a clause like this in the defsystem form:

("OWC10.SPREADSHEET" :type :midl-type-library-file
  :com :not-binary
  :component-name t)

To compile the same library, but to a different object file, use:

("my-owc" :type :midl-type-library-file
  :com :not-binary
  :component-name "OWC10.SPREADSHEET")

To compile the same library, but using only version newer than 1.1, use a clause like this:

("my-owc" :type :midl-type-library-file
  :com :not-binary
  :component-name ("OWC10.SPREADSHEET"
    :min-version "1.1"))
See also find-component-tlb
:midl-file

print-i-dispatch-methods

Function

Summary Prints the defined methods for an i-dispatch.

Package com

Signature print-i-dispatch-methods i-dispatch &optional arguments-p

Arguments i-dispatch An i-dispatch interface object.
arguments-p A boolean.

Description The function print-i-dispatch-methods prints the methods that are defined for the i-dispatch i-dispatch.

print-i-dispatch-methods tries to get the information about the methods of the i-dispatch and print them in a readable format. If arguments-p is nil then for each each method it prints its name, followed by the invocation type(s) inside curly brackets. Invocation types are:

"Method" Invoked by invoke-dispatch-method.
"Get" Invoked by invoke-dispatch-get-property.

If arguments-p is true, print-i-dispatch-methods also prints the types of the arguments for each method. The type of each argument is shown as a plain string followed by the VT_constant name delimited by curly brackets. The type may be preceded by:
By reference  Means the argument has VT_BYREF. The argument in that is passed in Lisp should be the actual type. By reference argument values are returned as multiple values, following the return value of the method if it has one.

Array of  Means it got VT_ARRAY. The argument in Lisp should be an array.

Array of references  Means it got VT_ARRAY and VT_BYREF. The argument needs to be an array of the actual type.

The default value of arguments-p is nil.

Notes 1. print-i-dispatch-methods gives only partial information, and is therefore useful only for the simple methods where it is pretty obvious what the arguments are. If the arguments are not obvious, you will need to read the actual documentation.

2. The type Variant means any type, but note that the method may accept only specific types even if the argument is variant.

See also get-i-dispatch-name
i-dispatch
invoke-dispatch-put-property
invoke-dispatch-get-property
invoke-dispatch-method
“Calling Automation methods without a type library” on page 92
query-simple-i-dispatch-interface

Function

Summary
Queries the interface pointer from a `simple-i-dispatch` object using the type information from another interface.

Package
com

Signature
`query-simple-i-dispatch-interface this &key related-dispatch => interface-ptr, refguid`

Arguments
- `this` A `simple-i-dispatch` object.
- `related-dispatch` An `i-dispatch` interface pointer.

Values
- `interface-ptr` An interface pointer.
- `refguid` A refguid.

Description
The function `query-simple-i-dispatch-interface` is used to obtain an interface pointer from a `simple-i-dispatch` interface. The `simple-i-dispatch` contains the interface name provided using its `:interface-name` initarg, but it does not have the details of this interface, so `query-simple-i-dispatch-interface` must be able to find the details.

In the current implementation, the only way for the details to be found is by passing the `related-dispatch` argument. This should be an interface pointer from which type information about the interface name can be obtained.

The `query-simple-i-dispatch-interface` function returns two values, `interface-ptr` which is an interface pointer for the interface-name contained in `this` and `refguid`, which is the refguid of that interface-name.

A typical use of `query-simple-i-dispatch-interface` is to implement a sink interface for events from some other component. The interface pointer for that component is passed as the `related-dispatch` because that connects to the type library containing both interface definitions.
Before using `query-simple-i-dispatch-interface` directly, consider the functions `set-i-dispatch-event-handler` and `create-instance-with-events`, which provide an succinct way to provide an event callback.

See also

- `simple-i-dispatch`
- `create-instance-with-events`
- `set-i-dispatch-event-handler`

### register-active-object

**Function**

**Summary**

Registers an instance of a coclass.

**Signature**

```
register-active-object interface-ptr &key clsid progid flags => token
```

**Arguments**

- `interface-ptr` A COM interface pointer.
- `clsid` A string or a `refguid` giving a CLSID to create.
- `progid` A string giving a ProgID to create.
- `flags` An integer.

**Values**

- `token` An integer.

**Description**

Registers `interface-ptr` in the system Running Object Table for a specific coclass that the application implements. The coclass can be specified directly by using the `clsid` argument or indirectly using the `progid` argument, which will locate the CLSID from the registry.

`flags` can be an integer as specified for the Win32 API function `RegisterActiveObject`. The default value of `flags` is 0.

The returned value `token` can be used with `revoke-active-object` to revoke the registration.
See also revoke-active-object

revoke-active-object

Function

Summary Unregisters a previously registered instance of a coclass.

Signature revoke-active-object token

Arguments token An integer.

Description Revokes the registration of the object associated with token in the system Running Object Table. The value of token should be one that was returned by a call to register-active-object.

See also register-active-object

set-error-info

Function

Summary Sets the error information for the current Automation method.

Package com

Signature set-error-info &key iid source description help-file help-context => error-code

Arguments iid The iid of the interface that defined the error, or nil if none. The iid can be a symbol naming the interface or a refguid foreign pointer.

source A string giving the ProgID for the class that raised the error, or nil if none.
**Description**

The function `set-error-info` allows the various components of the error information to be set for the current Automation method. It should only be called within the dynamic scope of the body of a `define-com-method` definition. The value `DISP_E_EXCEPTION` can be returned as the `hresult` of the method to indicate failure.

**Examples**

```lisp
(define-com-method (i-robot rotate)
  ((this i-robot-impl)
   (axis :in)
   (angle-delta :in))
  (let ((joint (find-joint axis)))
    (if joint
      (progn
        (rotate-joint joint)
        S_OK)
      (set-error-info :iid 'i-robot
        :description "Bad joint.")))))
```

**See also**

`define-com-method`
`get-error-info`
`refguid`
`hresult`

**set-i-dispatch-event-handler**

**Summary**

Sets an event handler for an `i-dispatch` interface.
Package

com

Signature

set-i-dispatch-event-handler (interface event-handler &key
all coclass event-object source-names) => sinks

Arguments

interface An i-dispatch interface.

event-handler A function of four arguments.

all A generalized boolean, default value false.

coclass The coclass to use, or nil.

event-object A Lisp object.

source-names A list of "source" interface names, or nil.

Values

sinks A list of objects representing the connections made.

Description

The function set-i-dispatch-event-handler sets an event handler for the i-dispatch interface interface.

event-handler is a function of four arguments:

event-handler event-obj method-name method-type args

event-obj is the value of event-object if this is non-nil. If event-object is nil, event-obj is the value of interface.

method-name is the method-name that has been called, which is the same as the "event" name in Visual Basic terminology.

method-type is the type of the method. For a normal "event" it is :method. method-type can also be :put or :get if the underlying "source" interface has "propput" or "propget" methods or properties.

args is an array containing the arguments to the method ("event"). This varies according to the method. For out or in-out arguments, it is possible to return a value by setting the corresponding value in the array.
The `all`, `coclasse` and `source-names` arguments to `set-i-dispatch-event-handler` tell it which "source" interface or interfaces to use. In most cases, the default is correct.

If `all` is false, then only the "default" "source" is used. If `all` is true, then `set-i-dispatch-event-handler` uses all the source interfaces that the coclass defines.

The `coclasse` tells `set-i-dispatch-event-handler` which coclass to use, which is the same as the object in Visual Basic terminology.

If `coclasse` is `nil`, it uses the first coclass in the type library that has the type of interface as a default interface, or if there is no such coclass, the first coclass that has this interface. In most of the cases this is the desired coclass.

If `coclasse` is non-nil, it specifies which coclass to use. It can be a ProgID (for example "Word.Application") or a coclass name or a coclass GUID. If the `i-dispatch` interface was created with `create-instance`, then the argument to `create-instance` is the correct coclass to use.

If `source-names` is non-nil, then it is a list of "source" interface names to use, and `all` and `coclasse` are ignored. If `source-names` is `nil`, then `set-i-dispatch-event-handler` calls `get-i-dispatch-source-names` to calculate the "source" interface names.

The `sinks` is a list of objects representing the connections that `set-i-dispatch-event-handler` made. When the events are no longer needed, they can be released by `disconnect-standard-sink`.

**Notes**

1. `set-i-dispatch-event-handler` can be called more than once on the same `i-dispatch`, and this generates new connections each time. Therefore, if it is called more than once such that it uses the same source names, events will arrive more than once.
2. If you need to call `set-i-dispatch-event-handler` repeatedly, then it is most efficient to call `get-i-dispatch-source-names` once and pass the result `source-names` to `set-i-dispatch-event-handler`.

3. There is a useful function `create-instance-with-events` which combines `create-instance` and `set-i-dispatch-event-handler`.

See also
- `disconnect-standard-sink`
- `create-instance-with-events`
- `get-i-dispatch-source-names`

---

**set-variant**

*Function*

**Summary**
Sets the fields in a `VARIANT` pointer.

**Package**
com

**Signature**

```
set-variant variant type &optional value
```

**Arguments**

- `variant` A foreign pointer to an object of type `VARIANT`.
- `type` A keyword specifying the type of value.
- `value` The value to store in `variant`.

**Description**

The function `set-variant` can be used to set the type and value of a `VARIANT` object. It is useful if the default type provided by the automatic conversion for `VARIANT` return values is incorrect. The value of meaning of `type` is an specified below.

<table>
<thead>
<tr>
<th>Value of <code>type</code></th>
<th>VT code used</th>
<th>Expected type of value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>nil</code></td>
<td><code>dynamic</code></td>
<td>any suitable</td>
</tr>
</tbody>
</table>
If \( type \) is \texttt{nil} then the actual VT code is chosen dynamically according to the Lisp type of \textit{value} (see Table 3.1, page 93).

If \( type \) is a cons of the form \((\texttt{array . type})\) for some keyword \textit{type}, then \texttt{variant} is set to contain an array of objects of \textit{type}. Each element of \textit{value} is expected to be suitable for conversion to \textit{type}.

<table>
<thead>
<tr>
<th>Value of \textit{type}</th>
<th>VT code used</th>
<th>Expected type of \textit{value}</th>
</tr>
</thead>
<tbody>
<tr>
<td>:empty</td>
<td>VTEMPTY</td>
<td>ignored</td>
</tr>
<tr>
<td>:null</td>
<td>VTNUL</td>
<td>ignored</td>
</tr>
<tr>
<td>:short</td>
<td>VT_I2</td>
<td>integer</td>
</tr>
<tr>
<td>:long</td>
<td>VT_I4</td>
<td>integer</td>
</tr>
<tr>
<td>:float</td>
<td>VT_R4</td>
<td>single-float</td>
</tr>
<tr>
<td>:double</td>
<td>VT_R8</td>
<td>double-float</td>
</tr>
<tr>
<td>:cy</td>
<td>VT_CY</td>
<td></td>
</tr>
<tr>
<td>:date</td>
<td>VT_DATE</td>
<td></td>
</tr>
<tr>
<td>:bstr</td>
<td>VTBSTR</td>
<td>string</td>
</tr>
<tr>
<td>:dispatch</td>
<td>VTDISPATCH</td>
<td>FLI pointer</td>
</tr>
<tr>
<td>:error</td>
<td>VTERRO</td>
<td>ignored</td>
</tr>
<tr>
<td>:bool</td>
<td>VTBOLL</td>
<td>nil or non-nil</td>
</tr>
<tr>
<td>:variant</td>
<td>VT_VARIANT</td>
<td>FLI pointer</td>
</tr>
<tr>
<td>:unknown</td>
<td>VTUNKNOWN</td>
<td>FLI pointer</td>
</tr>
<tr>
<td>:decimal</td>
<td>VTDECIMAL</td>
<td></td>
</tr>
<tr>
<td>(:unsigned :char)</td>
<td>VT_UI1</td>
<td>integer</td>
</tr>
<tr>
<td>(:array. type)</td>
<td>VTBYREF +</td>
<td>array</td>
</tr>
</tbody>
</table>
|                        | VT code for \textit{type} | |}
| :array | VTARRAY + | array |}
| or (:array array) or (:array . types) | VT_VARIANT | array |}
| (:pointer type2) | VTBYREF + | FLI pointer | VT code for \textit{type2} |}
If type is :array or another list starting with :array then variant is set to contain an array of VARIANT objects with the same dimensions as value. Each element of value is converted as if by calling set-variant with a type chosen as follows:

- If type is the symbol :array, then nil is passed as the element type.
- If type is of the form (:array array) then array should be an array with the same dimensions as value. The element type is taken from the corresponding element of array.
- If type is of the form (:array . types) then types should be a suitable value for the :initial-contents argument to make-array to make an array of types with the same dimensions as value. The element type is taken from the corresponding element of that array. In particular, if value is a vector of length n then type should be a list of the form (:array type1 type2 ... typen).

Examples

(set-variant v :null)
(set-variant v :short 10)
(set-variant v '(:pointer :short) ptr)
(set-variant v '(:array :short :int) #(1 2))

See also define-com-method

**simple-i-dispatch**

**Summary**
A complete dynamic implementation of the i-dispatch interface.

**Package**
com

**Superclasses**
standard-i-dispatch

**Subclasses**
None
Initargs

:interface-name

The name of the interface to implement. See
query-simple-i-dispatch-interface for
details on how this is used.

:invoke-callback

A function that is called with four argu-
ments whenever one of the interface's meth-
ods is invoked. The arguments are the
callback object, the method name as a string,
the method type (a keyword :method, :get
or :put) and a vector of the method's argu-
ments. The value returned by the function
will be returned to the caller of the method
See com-object-dispinterface-invoke
for more details of the method name, type
and arguments.

Accessors

simple-i-dispatch-invoke-callback

Readers

simple-i-dispatch-interface-name
simple-i-dispatch-refguid

Description

The class simple-i-dispatch provides a complete imple-
mentation of the i-dispatch interface, without requiring a
type library to be parsed. The type information is obtained at
run-time when query-simple-i-dispatch-interface is
called. The class inherits from standard-i-dispatch to pro-
vide the i-unknown interface.

The simple-i-dispatch-refguid reader can be used to
return the refguid of the interface. This can only be called
after query-simple-i-dispatch-interface has been
called.

The implementation obtains the callback object argument to
the invoke-callback by calling simple-i-dispatch-call-
back-object with the simple-i-dispatch object. The
default method returns the simple-i-dispatch object itself,
but this method can be overridden for subclasses to return some other object.

Before using `simple-i-dispatch` directly, consider the functions `set-i-dispatch-event-handler` and `create-instance-with-events`, which provide an succinct way to provide an event callback.

See also
- `query-simple-i-dispatch-interface`
- `simple-i-dispatch-callback-object`
- `standard-i-dispatch`
- `i-dispatch`
- `capi:ole-control-pane-simple-sink`

### simple-i-dispatch-callback-object

**Generic Function**

**Summary**
A generic function that can be implemented to modify the first argument to the `invoke-callback` in `simple-i-dispatch`.

**Package**
com

**Signature**

\[
\text{this} => \text{object}
\]

**Method signature**

\[
(\text{this simple-i-dispatch}) => \text{this}
\]

**Arguments**
\[
\text{this} \quad \text{An object of type simple-i-dispatch.}
\]

**Values**
\[
\text{object} \quad \text{The callback object to be pass as the first argument to the invoke-callback of this.}
\]

**Description**
The generic function `simple-i-dispatch-callback-object` is called by the implementation of `simple-i-dispatch` to obtain the callback object (first argument) to its `invoke-callback`. This allows the object to be computed in some way by subclassing `simple-i-dispatch` and implementing
a method on `simple-i-dispatch-callback-object` specialized for the subclass.

The pre-defined primary method specializing on `simple-i-dispatch` always returns its argument.

**Example**

When the function `my-dispatch-callback` below is called, its first argument will be the `useful-object` passed to `make-my-dispatch`.

```lisp
(defun make-my-dispatch (useful-object)
  (make-instance 'my-dispatch :useful-object useful-object :invoke-callback 'my-dispatch-callback :interface-name "MyDispatchInterface"))
```

**See also**

`simple-i-dispatch`

---

**standard-automation-collection**

*Class*

**Summary**

A framework for implementing Automation collections.

**Package**

com

**Superclasses**

`standard-i-dispatch`

**Initargs**

- `:count-function`
  
  A function of no arguments that should return the number of items in the collection. This initarg is required.

- `:items-function`
A function of no arguments that should return a sequence of items in the collection. This function is called by the implementation of _NewEnum and the sequence is copied. Exactly one of :items-function and :item-generator-function must be specified.

:items-function
A function of no arguments that should return a sequence of items in the collection. This function is called by the implementation of _NewEnum and the sequence is copied. Exactly one of :items-function and :item-generator-function must be specified.

:item-generator-function
A function of no arguments that should return an item generator, which will generate the items in the collection. See below for more details. Exactly one of :items-function and :item-generator-function must be specified.

:data-function
A function called on each item that the :items-function or :item-generator-function returns. This is called when iterating, to produce the value that is returned to the caller.

:item-lookup-function
A function which takes a single argument, an integer or a string specifying an item. The function should return the item specified. This initarg is required if the :item-method option is non-nil in define-automation-collection.

Description
The class standard-automation-collection provides a framework for implementing Automation collections. These typically provide a.Count property giving the number of objects in the collect, a _NewEnum property for iterating over the element of the collection method and optionally an Item method for finding items by index or name.
The :count-function initarg specifies a function to count the items of the collection and is invoked by the implementation of the Count method.

Exactly one of the initargs :item-function and :item-generator-function must be specified to provide items for the implementation of the IEnumVARIANT instance returned by the _NewEnum method.

If :items-function is specified, then it will be called once when _NewEnum is called and should return a sequence of the items in the collection. This sequence is copied, so can be modified by the program without affecting the collection.

If :item-generator-function is specified, it should be an item generator that will generate all the items in the collection. It will be called once with the argument :clone when _NewEnum is called and then by the implementation of the resulting IEnumVARIANT interface. An item generator is a function of one argument which specifies what to do:

[next] Return two values: the next item and t. If there are no more items, return nil and nil.

[skip] If there are no more items, return nil. Otherwise skip the current item and return t.

[reset] Reset the generator so the first item will be returned again.

[clone] Return a copy of the item generator. The copy should have the same current item.

The :data-function initarg should be function to convert each item returned by the :items-function or the item generator into a value whose type is compatible with Automation (see Table 3.1, page 93). The default function is identity.

Example See the example in this directory:

(example-edit-file "com/automation/collections")
See also define-automation-collection
standard-i-dispatch
i-dispatch

standard-i-connection-point-container  

Class

Summary  
A complete implementation of the Connection Point protocol.

Package  
com

Superclasses  
standard-i-unknown

Description  
The class standard-i-connection-point-container provides a complete implementation of the Connection Point protocols. It implements the IConnectionPointContainer interface and creates connection points for each interface given by the :outgoing-interfaces initarg.

If a class defined with define-automation-component macro specifies the :source-interfaces option or has interfaces with the "source" attribute in its coclass then it must inherit from standard-i-connection-point-container somehow. define-automation-component passes the appropriate initargs to initialize the class.

The macro do-connections can be used to iterate over the connections (sinks) for a given interface.

Example  
Given the class definition

(define-automation-component clonable-component ()
   ()
   (:interfaces i-clonable)
   (:source-interfaces i-clonable-events)
)

then
(typep (make-instance 'clonable-component)
   'standard-i-connection-point-container)
=> t

See also
define-automation-component
standard-i-dispatch
do-connections
define-automation-collection
standard-i-unknown
i-dispatch

standard-i-dispatch Class

Summary A complete implementation of the i-dispatch interface.

Package com

Superclasses standard-i-unknown

Subclasses standard-automation-collection
   simple-i-dispatch

Description The class standard-i-dispatch provides a complete imple-
   mentation of the i-dispatch interface, based on the type
   information in the type library. In addition, the
   i-support-error-info interface is implemented to support
   error information. standard-i-dispatch inherits from
   standard-i-unknown to provide the i-unknown interface.

All classes defined with the define-automation-component
and define-automation-collection macros must inherit
from standard-i-dispatch somehow. These macros pass
the appropriate initargs to initialize the class.

Example Given the class definition
(define-automation-component document-impl ()
  ()
  (:coclass document)
)

then

(typep (make-instance 'document-impl)  
          'standard-i-dispatch)  
=> t

See also define-automation-component  
define-automation-collection  
standard-i-connection-point-container  
standard-i-unknown  
i-dispatch

**with-coclass**

*Macro*

**Summary**

Executes a body of code with a temporary instance of a coclass.

**Package**

com

**Signature**

with-coclass disp form* => values

disp ::= (dispatch-function coclass-name &key interface-name punk clsctx)

**Arguments**

disp The names of the dispatch function, coclass and so on.

**dispatch-function** A symbol which will be defined as a macro,  
as if by with-dispatch-interface. The macro can be used by the forms to invoke the Automation methods of the component.

**coclass-name** A symbol which names the coclass. It is not evaluated.
interface-name  A symbol naming an interface in the coclass.
It is not evaluated.

punk  A symbol which will be bound to the interface pointer.

clsctx  A CLSCTX value, which defaults to CLSCTX_SERVER.

form  A form to be evaluated.

Values

values  The values returned by the last form.

Description

Calls create-object to make an instance of the coclass named by the symbol coclass-name. If interface-name is given then that interface is queried from the component, otherwise the default interface is queried. Each form is evaluated in turn with dispatch-function bound of a local macro for invoking methods on the interface, as if by with-dispatch-interface. After the forms have been evaluated, the interface pointer is released. If punk is given, it will be bound to the interface pointer while the forms are being evaluated.

Example

If a type library containing the coclass TestComponent has been converted to Lisp, then following can be used to make an instance of component and invoke the Greet() method on the default interface.

(with-coclass (call-it test-component)
  (call-it greet "hello"))

See also

create-object

with-dispatch-interface  

Macro

Summary  Used to simplify invocation of several methods from a particular Automation interface pointer.
4 Automation Reference Entries

Package  
\hspace{1cm} \textbf{com}

Signature  
\textbf{with-dispatch-interface} \hspace{.1cm} \textit{disp} \hspace{.1cm} \textit{dispinterface-ptr} \hspace{.1cm} \textit{form}\textsuperscript{*} \Rightarrow \textit{values}

\hspace{.5cm} \textit{disp} ::= \ (\textit{dispatch-function} \hspace{.1cm} \textit{dispinterface-name})

Arguments  
\hspace{.5cm} \textit{disp} \hspace{1.5cm} \text{The names of the dispatch function and Automation interface.}

\hspace{1cm} \textit{dispatch-function} \hspace{1.5cm} \text{A symbol which will be defined as a macro, as if by \textbf{macrolet}. The macro can be used by the forms to invoke the methods on \textit{dispinterface-ptr}.}

\hspace{1cm} \textit{dispinterface-name} \hspace{1.5cm} \text{A symbol which names the Automation interface. It is not evaluated.}

\hspace{1cm} \textit{dispinterface-ptr} \hspace{1.5cm} \text{A form which is evaluated to yield a COM \textbf{i-dispatch} interface pointer.}

\hspace{1cm} \textit{form} \hspace{1.5cm} \text{A form to be evaluated.}

Values  
\hspace{.5cm} \textit{values} \hspace{1.5cm} \text{The values returned by the last \textit{form}.}

Description  
When the macro \textbf{with-dispatch-interface} evaluates the \textit{forms}, the local macro \textit{dispatch-function} can be used to invoked the methods for the Automation interface \textit{dispinterface-name}, which should be the type or a supertype of the actual type of the Automation interface pointer \textit{dispinterface-ptr}.

The \textit{dispatch-function} macro has the following signature:

\hspace{1cm} \textit{dispatch-function} \hspace{.1cm} \textit{method-name} \hspace{.1cm} \textit{arg}\textsuperscript{*} \Rightarrow \textit{values}

\hspace{2cm} \text{where}

\hspace{2.5cm} \textit{method-name} \hspace{1.5cm} \text{A symbol which names the method. It is not evaluated.}
Arguments to the method (see Section 3.3.3, “Data conversion when calling Automation methods” for details).

Values from the method (see Section 3.3.3, “Data conversion when calling Automation methods” for details).

For example, in order to invoke the ReFormat method of a MyDocument interface pointer

(\texttt{with-dispatch-interface (call-doc my-document) doc (call-doc \texttt{re-format})})

See also \texttt{call-dispatch-method}
The tools described in this chapter extend the LispWorks IDE to help with debugging applications using COM/Automation. See the LispWorks IDE User Guide for more details of common operations that can be performed within these tools. The sections below describe each tool.

5.1 The COM Implementation Browser

The COM Implementation Browser allows prototype code for COM implementation classes to be viewed and created. This is useful when writing COM methods because it provides a template for the method names and arguments.
To start the tool, choose **Tools > Com Implementation Browser** from the Lisp-Works podium.
At the top of the window is a drop down list a class names. Choosing an item from this list will set the contents of the Description panel to show that class at the root of the tree, with subitems for each COM interface that it implements. The COM interfaces have subitems for their uuids and methods. The icon used for a method in the tree indicates the status of its implementation: red means not implemented (see Section 1.8.4 on page 17), yellow means inherited from a superclass (see Section 1.8.5 on page 17), red and yellow means an inherited unimplemented method and cyan means a method implemented directly in the named class.

Selecting an item in the Description pane will display a prototype implementation for that part of the class, using the appropriate macros for COM and Automation classes.

The New and Edit buttons allow prototype classes to be constructed and modified. Such classes are shown in the list of class names as Example class... and are not actually defined, but the prototype code can be copied into a file and
5 Tools

evaluated to provide a starting point for an implementation. Clicking **New** or **Edit** displays a dialog as shown below.

The class name is displayed at the top and can be edited. For COM object classes, the list at the bottom of the dialog shows the COM interfaces that the class will implement. For Automation interfaces, a type library must be chosen from the drop-down list and one of the **Coclass** or **Interfaces** options selected to show the list of coclasses or interfaces that the class will implement. Click **OK** to confirm your choice or **Cancel** to discard it.
5.2 The COM Object Browser

The COM Object Browser is used to view COM objects for the classes implemented by Lisp. To start the tool, choose **Tools > Com Object Browser** from the LispWorks podium.

The **Active COM Objects** list shows all the Lisp objects that are known to the COM runtime system. Selecting objects from this list will list the COM interface pointers that have been queried for these objects. Double clicking on either list will inspect the data. Use the **Works > Object** menu or the context menu to perform other operations on the selected COM Objects.
5.3 The COM Interface Browser

The COM Interface Browser allows the interfaces that have been converted to FLI definitions to be viewed. To start the tool, choose **Tools > Com Interface Browser** from the LispWorks podium.

The left hand pane shows a tree of the interfaces, with subitems for their uuids and methods. Selecting an item will cause the right-hand pane to show prototype code for invoking the method(s) selected.
5.4 Editor extensions

The LispWorks editor has been enhanced to support COM.

5.4.1 Inserting GUIDs

The editor command Insert GUID can be used to insert a new GUID at the current point. The GUID is made by calling CoCreateGUID.

5.4.2 Argument lists

The editor command Function Arglist (Alt+)= has been extended to show the arguments for all COM methods which match the function name.
5 Tools
This chapter enumerates the set of examples in the LispWorks library relevant to the content of this manual. Each example file 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. In some cases you can simply compile the example code, by `Ctrl+Shift+B`, and then place the cursor at the end of the entry point form and press `Ctrl+X Ctrl+E` to run it. However the comments near the start of the file may have specific instructions, such as how to build a delivered executable or library, so follow these if present.

### 6.1 Argument passing

These files comprise an example illustrating various argument passing issues when calling and implementing COM methods. To run the example, follow the instructions in `defsys.lisp`.

```lisp
(example-edit-file "com/manual/args/defsys")
(example-edit-file "com/manual/args/args.idl")
```
6.2 Aggregation

These three files contain a simple demonstration of implementing aggregation:

(example-edit-file "com/com/aggregation-defsys")
(example-edit-file "com/com/aggregation-idl.idl")
(example-edit-file "com/com/aggregation")

6.3 OLE embedding of external components

These examples illustrate OLE embedding of external components in a CAPI interface:

(example-edit-file "com/ole/html-viewer")
(example-edit-file "com/ole/flash-player")
(example-edit-file "com/ole/simple-container/doc-viewer-pair")

These three files together comprise an example also illustrating OLE embedding: Start by loading the first file:

(example-edit-file "com/ole/simple-container/do-simple-spreadsheet")
(example-edit-file "com/ole/simple-container/defsys")
(example-edit-file "com/ole/simple-container/owc-spreadsheet")

6.4 Building an ActiveX control

These three files together comprise an example which illustrates building an ActiveX control. Start by reading the comments in the first file:

(example-edit-file "com/ole/control-implementation/deliver")
(example-edit-file "com/ole/control-implementation/defsys")
6.5 OLE automation

These examples illustrate using OLE automation:

(example-edit-file "com/automation/internet-explorer/simple")
(example-edit-file "com/automation/excel/pie-chart")

This is a simple example of an Automation collection interface. Follow the instructions in defsys.lisp:

(example-edit-file "com/automation/collections/defsys")
(example-edit-file "com/automation/collections/collection-test.idl")
(example-edit-file "com/automation/collections/client")
(example-edit-file "com/automation/collections/server")
(example-edit-file "com/automation/collections/compile-tlb")

This is an example of building and testing a CAPI application that can be controlled by Automation. Start with readme.txt:

(example-edit-file "com/automation/capi-application/readme.txt")
(example-edit-file "com/automation/capi-application/build")
(example-edit-file "com/automation/capi-application/defsys")
(example-edit-file "com/automation/capi-application/listapp.idl")
(example-edit-file "com/automation/capi-application/listapp.tlb")
(example-edit-file "com/automation/capi-application/automation")
(example-edit-file "com/automation/capi-application/application")
(example-edit-file "com/automation/capi-application/test")

This file shows how you can embed the new ActiveX control in another application:

(example-edit-file "com/ole/control-implementation/lisp-container")

6.5 OLE automation

These examples illustrate using OLE automation:

(example-edit-file "com/automation/internet-explorer/simple")
(example-edit-file "com/automation/excel/pie-chart")

This is a simple example of an Automation collection interface. Follow the instructions in defsys.lisp:

(example-edit-file "com/automation/collections/defsys")
(example-edit-file "com/automation/collections/collection-test.idl")
(example-edit-file "com/automation/collections/client")
(example-edit-file "com/automation/collections/server")
(example-edit-file "com/automation/collections/compile-tlb")

This is an example of building and testing a CAPI application that can be controlled by Automation. Start with readme.txt:

(example-edit-file "com/automation/capi-application/readme.txt")
(example-edit-file "com/automation/capi-application/build")
(example-edit-file "com/automation/capi-application/defsys")
(example-edit-file "com/automation/capi-application/listapp.idl")
(example-edit-file "com/automation/capi-application/listapp.tlb")
(example-edit-file "com/automation/capi-application/automation")
(example-edit-file "com/automation/capi-application/application")
(example-edit-file "com/automation/capi-application/test")
These two files illustrate use of the CrystalDesignRunTime component:

(example-edit-file "com/automation/crystal-reports/deliver")
(example-edit-file "com/automation/crystal-reports/aubrowse")

This example illustrates using events with Internet Explorer:

(example-edit-file "com/automation/events/ie-events")

This is an example of building an Automation server without a GUI.

(example-edit-file "com/automation/cl-smtp/clsmtp-impl-build")
(example-edit-file "com/automation/cl-smtp/clsmtp.idl")
(example-edit-file "com/automation/cl-smtp/clsmtp.tlb")
(example-edit-file "com/automation/cl-smtp/clsmtp-impl")
(example-edit-file "com/automation/cl-smtp/server")
(example-edit-file "com/automation/cl-smtp/clsmtp-test")
Index

A
accessor functions
  lisp-variant-type 131
  lisp-variant-value 131
ActiveX controls vii
add-ref function 4, 27
automation-server-command-line-action function 28
automation-server-main function 29
automation-server-top-loop function 32

C
call-com-interface macro 4, 33
call-com-object macro 15, 24, 35
call-dispatch-get-property macro 103
call-dispatch-method macro 104
call-dispatch-put-property macro 106
Calling
  Automation methods
    using a type library 91
    without using a type library 92
  COM interface methods 4
  COM object methods 24
check-hresult macro 36
class options
  :coclass 114
  :coclass-reusable-p 115
  :dont-implement 50
  :extra-interfaces 115
  :inherit-from 49
  :interface 112
  :interfaces 49, 114
  :item-method 112
  :source-interfaces 115
classes
  com-dispatch-involve-excep-
tion-error 101
  com-error 41
  com-interface 42
  com-object 43
  simple-i-dispatch 148
  standard-automation-collec-
tion 151
  standard-i-connection-
point-container 154
  standard-i-dispatch 155
  standard-i-unknown 77
  :coclass class option 114
  :coclass-reusable-p class option
    115
  co-create-guid function 37
  co-initialize function 14, 38
collections
    implementing 97
    using 94
COM interface types
  i-dispatch 128
  i-unknown 57
  com-dispatch-involve-excep-
tion-error 101
  com-dispatch-involve-excep-
tion-error-info function
Index

com-error class 41
com-error-function-name function 41
com-error-hresult function 41
com-interface class 4, 42, 92, 93
com-interface-refguid function 42
com-object class 43
com-object-destructor function 16, 43
com-object-dispinterface-invokes generic function 107
com-object-from-pointer function 44
com-object-initialize function 16, 45
com-object-query-interface function 46
compiling IDL files 1
connection points
  implementing 98
  using 94
CoTaskMemAlloc 39
co-task-mem-alloc function 10, 38
CoTaskMemFree 40
co-task-mem-free function 8, 10, 40
co-uninitialize function 40
:count-function initarg 151
create-instance function 47
create-instance-with-events function 109
create-object function 110

D
: data-function initarg 152
define-automation-collection macro 111
define-automation-component macro 113
define-com-implementation macro 14, 48
define-com-method macro 14, 51
define-dispinterface-method macro 116
defsystem member types
  :midl-file 65
  :midl-type-library-file 136
deliver function 2, 31, 33
destruction 16
discard-connection function 121
disconnect-standard-sink function 118
dispatcher 90, 96, 97, 103, 105, 106, 107, 116, 158
:dll-exports Delivery keyword 2, 76
do-collection-items macro 119
do-connections macro 120
:dont-implement class option 50
dual interface 90, 96

E
editor commands
  Function Arglist 167
  Insert GUID 167
environment variables
  INCLUDE 62, 65
errors
  handling in Automation 95
  handling in COM 12
  reporting 98
events
  see connection-points
  :extra-interfaces class option 115

F
find-clsid function 53
find-component-tlb function 122
find-component-value function 123
FLI types
  hresult 56
  refguid 68
  refiid 69
Function Arglist editor command 167
: function-name initarg 41
functions
  add-ref 27
  automation-server-command-line-action 28
  automation-server-main 29
  automation-server-top-loop 32
co-create-guid 37
co-initialize 14, 38
com-dispatch-invocation-error-info 102
com-error-function-name 41
com-error-hresult 41
com-interface-refguid 42
com-object-destructor 16, 43
com-object-from-pointer 44
com-object-initialize 16, 45
Index

com-object-query-interface 46
co-task-mem-alloc 10, 38
co-task-mem-free 8, 10, 40
co-uninitialize 40
create-instance 47
create-instance-with-events 109
create-object 110
discard-connection 121
disconnect-standard-sink 118
find-clsid 53
find-component-tlb 122
find-component-value 123
get-error-info 125
get-i-dispatch-name 126
guid-equal 55
guid-to-string 56
hresult-equal 57
interface-connect 129, 130
invoke-dispatch-get-property 131
invoke-dispatch-method 133
invoke-dispatch-put-property 134
make-factory-entry 14, 16, 59
make-guid-from-string 60
make-lisp-variant 136
midl 2, 61
midl-default-import-paths 64
midl-set-import-paths 65
print-i-dispatch-methods 138
query-interface 66
refguid-interface-name 69
register-class-factory-entry 14, 16, 70
register-server 71
release 72
server-can-exit-p 74
server-in-use-p 74
set-automation-server-exit-delay 75
set-error-info 142
set-i-dispatch-event-handler 143
set-register-server-error-reporter 75
set-variant 146
start-factories 14, 16, 78, 79
unregister-server 80

G
Garbage collection 16
generic functions
com-object-dispinterface-invole 107
simple-i-dispatch-callback-object 150
get-error-info function 12, 125
get-i-dispatch-name function 126
get-i-dispatch-source-names function 127
get-object function 54
guid-equal function 55
guid-to-string function 56

H
hresult FLI type 56
:hresult initarg 41
hresult-equal function 57

I
i-dispatch COM interface type 128
IDL
compiling 1
iid_is attribute 8
in parameters 6, 21, 24, 93
INCLUDE environment variable 62, 65
:inherit-from class option 49
initialization
CLOS object 15
COM object 15
in-out parameters 10, 23, 25, 93
Insert GUID editor command 167
:interface class option 112
interface-connect function 129, 130
:interface-name initarg 149
interface-ref macro 58
:interfaces class option 49, 114
:invoke-callback initarg 149
invoke-dispatch-get-property function 131
invoke-dispatch-method function 133
invoke-dispatch-put-property function 134
:item-generator-function ini-
Index

targ 152
: item-lookup-function initarg 152
: item-method class option 112
: items-function initarg 151
i-unknown COM interface type 57

L
lisp-variant type 131
lisp-variant-type accessor function 131
lisp-variant-value accessor function 131

M
macros
call-com-interface 33
call-com-object 15, 35
call-dispatch-get-property 103
call-dispatch-method 104
call-dispatch-put-property 106
check-hresult 36
define-automation-collection 111
define-automation-component 113
define-com-implementation 14, 48
define-com-method 14, 51
define-dispatch-interface-method 116
do-collection-items 119
do-connections 120
interface-ref 58
query-object-interface 15, 67
s_ok 73
succeeded 79
with-coclass 156
with-com-interface 81
with-com-object 83
with-dispatch-interface 157
with-query-interface 86
with-temp-interface 85
make-factory-entry function 14, 16, 59
make-guid-from-string function 60
make-lisp-variant function 136
making a COM DLL 2
midl function 2, 61

midl.exe 2, 5, 20
midl-default-import-paths function 64
midl-set-import-paths function 65
midl-type-library-file defsystem member type 136
modules
  automation 89
  com 1, 89

N
name mapping 3
New in LispWorks 7.0
  modi-default-import-paths function 64
  midl-set-import-paths function 65
Optional Automation parameters can be passed as :not-specified 94
print-i-dispatch-methods function 138
Search paths for IDL import statements 63
set-register-server-error-reporter function 75
Newly documented in LispWorks 7.0
  :type-library class option for define-automation-component 116

O
OLE vii
other applications
  registering objects for 98
out parameters 7, 22, 25, 93
:outer-unknown initarg 77

P
parameter direction
  in 6, 21, 24, 93
  in-out 10, 23, 25, 93
  out 7, 22, 25, 93
Primitive types 5, 20
print-i-dispatch-methods function 138
proppget attribute 3
proppput attribute 3
proppputref attribute 3
Index

Q
query-interface function 4, 66
query-object-interface macro 15, 67
query-simple-i-dispatch-interface function 140
:quit-when-no-windows Delivery keyword 33

R
refguid FLI type 68
refguid-interface-name function 69
refiid FLI type 4, 69
register-class-factory-entry function 14, 16, 70
register-server function 71
registry
  component values 123
  guid 53
  ProgID 53
  type library versions 122
release function 4, 72
retval attribute 93

S
s_ok macro 73
save-image function 2, 31
Self-contained examples
  ActiveX controls 170
  aggregation 170
  argument passing 169
  Automation 99
  calling and implementing COM methods 169
  COM/Automation 169, 170
  Controlling an Automation application 99
  embedding external components 170
  event handlers 172
  events 172
  Getting events from COM interfaces 99
  OLE automation 171
  OLE embedding 170
server-can-exit-p function 74
server-in-use-p function 74
set-automation-server-exit-delay function 75
set-error-info function 53, 98, 142
set-i-dispatch-event-handler function 143
set-register-server-error-reporter function 75
set-variant function 146
simple-i-dispatch class 148
simple-i-dispatch-callback-object generic function 150
size_is attribute 6, 8, 10, 21, 22, 23, 24, 25
source attribute 115
source interfaces 98
:source-interfaces class option 115
standard-automation-collection class 151
standard-i-connection-point-container class 154
standard-i-dispatch class 155
standard-i-unknown class 77
start-factories function 14, 16, 78, 79
string attribute 6, 7, 10, 21, 22, 23, 24, 25
succeeded macro 79

T
tools
  COM Implementation Browser 161
  COM Interface Browser 166
  COM Object Browser 165
type libraries 89
types
  lisp-variant 131

U
unregister-server function 80

W
Windows registry 53, 122, 123
with-coclass macro 156
with-com-interface macro 4, 81
with-com-object macro 24, 83
with-dispatch-interface macro 157
with-query-interface macro 4, 86
with-temp-interface macro 4, 85