Orbix Mainframe 6.3.1

COBOL Programmer's Guide and Reference

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Preface

Orbix is a full implementation of the Common Object Request Broker Architecture (CORBA), as specified by the Object Management Group (OMG). Orbix complies with the following specifications:

- CORBA 2.6
- GIOP 1.2 (default), 1.1, and 1.0

Orbix Mainframe is an implementation of the CORBA standard for the z/OS platform. Orbix Mainframe documentation is periodically updated. New versions between release are available at:

https://www.microfocus.com/documentation/orbix/

Audience

This guide is intended for COBOL application programmers who want to develop Orbix applications in a native z/OS environment.

Supported compilers

See the section *Supported Platforms and Compilers* in the Orbix Mainframe Release Notes for information on supported compilers.

Organization of this guide

This guide is divided as follows:

Part 1, Programmer's Guide

Chapter 1, Introduction to Orbix

With Orbix, you can develop and deploy large-scale enterprise-wide CORBA systems in languages such as COBOL, PL/I, C++, and Java. Orbix has an advanced modular architecture that lets you configure and change functionality without modifying your application code, and a rich deployment architecture that lets you configure and manage a complex distributed system. Orbix Mainframe is Micro Focus's CORBA solution for the z/OS environment.

Chapter 2, Getting Started in Batch

This chapter introduces batch application programming with Orbix, by showing how to use Orbix to develop a simple distributed application that features a COBOL client and server, each running in its own region.

Chapter 3, Getting Started in IMS

This chapter introduces IMS application programming with Orbix, by showing how to use Orbix to develop both an IMS COBOL client and an IMS COBOL server. It also provides details of how to subsequently run the IMS client against a COBOL batch server, and how to run a COBOL batch client against the IMS server.

Chapter 4, Getting Started in CICS

This chapter introduces CICS application programming with Orbix, by showing how to use Orbix to develop both a CICS COBOL client and a CICS COBOL server. It also provides details of how to subsequently run the CICS client against a COBOL batch server, and how to run a COBOL batch client against the CICS server.

Chapter 5, IDL Interfaces

The CORBA Interface Definition Language (IDL) is used to describe the interfaces of objects in an enterprise application. An object's interface describes that object to potential clients through its attributes and operations, and their signatures. This chapter describes IDL semantics and uses.

Chapter 6, IDL-to-COBOL Mapping

The CORBA Interface Definition Language (IDL) is used to define interfaces that are exposed by servers in your network. This chapter describes the standard IDL-to-COBOL mapping rules and shows, by example, how each IDL type is represented in COBOL.

Chapter 7, Orbix IDL Compiler

This chapter describes the Orbix IDL compiler in terms of how to run it in batch and z/OS UNIX System Services, the COBOL members that it creates, the arguments that you can use with it, and the configuration settings that it uses.

Chapter 8, Memory Handling

Memory handling must be performed when using dynamic structures such as unbounded strings, unbounded sequences, and anys. This chapter provides details of responsibility for the allocation and subsequent release of dynamic memory for these complex types at the various stages of an Orbix COBOL application. It first describes in detail the memory handling rules adopted by the COBOL runtime for operation parameters relating to different dynamic structures. It then provides a type-specific breakdown of the APIs that are used to allocate and release memory for these dynamic structures.

Part 2, Programmer's Reference

Chapter 9, API Reference

This chapter summarizes the API functions that are defined for the Orbix COBOL runtime, in pseudo-code. It explains how to use each function, with an example of how to call it from COBOL.

Part 3, Appendices

Appendix A, POA Policies

This appendix summarizes the POA policies that are supported by the Orbix COBOL runtime, and the argument used with each policy.

Appendix B, System Exceptions

This appendix summarizes the Orbix system exceptions that are specific to the Orbix COBOL runtime.

Appendix C, Installed Data Sets

This appendix provides an overview listing of the data sets installed with Orbix Mainframe that are relevant to development and deployment of COBOL applications.

Additional resources

The Knowledge Base contains helpful articles, written by experts, about Orbix Mainframe, and other products:

https://community.microfocus.com/t5/Orbix/ct-p/Orbix

If you need help with Orbix Mainframe or any other products, contact technical support:

https://www.microfocus.com/en-us/support/

Typographical conventions

This guide uses the following typographical conventions:

`Constant width` — Constant width (courier font) in normal text represents portions of code and literal names of items such as classes, functions, variables, and data structures. For example, text might refer to the `CORBA::Object` class.

Constant width paragraphs represent code examples or information a system displays on the screen. For example:

```
#include <stdio.h>
```

Italic — Italic words in normal text represent *emphasis* and *new terms*.

Italic words or characters in code and commands represent variable values you must supply, such as arguments to commands or path names for your particular system. For example:

`% cd /users/`*your_name*

Note: Some command examples may use angle brackets to represent variable values you must supply. This is an older convention that is replaced with *italic* words or characters.

Keying conventions

This guide may use the following keying conventions:

No prompt	When a command's format is the same for multiple platforms, a prompt is not used.
`%`	A percent sign represents the UNIX command shell prompt for a command that does not require root privileges.
`#`	A number sign represents the UNIX command shell prompt for a command that requires root privileges.
>	The notation > represents the DOS, Windows NT, Windows 95, or Windows 98 command prompt.

`...`
`.`
`.`
`.`
	Horizontal or vertical ellipses in format and syntax descriptions indicate that material has been eliminated to simplify a discussion.

[ ]	Brackets enclose optional items in format and syntax descriptions.
{ }	Braces enclose a list from which you must choose an item in format and syntax descriptions.
|	A vertical bar separates items in a list of choices enclosed in { } (braces) in format and syntax descriptions.

Part 1

Programmer's Guide

In this part

This part contains the following chapters:

Introduction to Orbix

With Orbix, you can develop and deploy large-scale enterprise-wide CORBA systems in languages such as COBOL, PL/I, C++, and Java. Orbix has an advanced modular architecture that lets you configure and change functionality without modifying your application code, and a rich deployment architecture that lets you configure and manage a complex distributed system. Orbix Mainframe is Micro Focus's CORBA solution for the z/OS environment.

In this chapter

This chapter discusses the following topics:

Why CORBA?

Need for open systems

Today's enterprises need flexible, open information systems. Most enterprises must cope with a wide range of technologies, operating systems, hardware platforms, and programming languages. Each of these is good at some important business task; all of them must work together for the business to function.

The common object request broker architecture—CORBA—provides the foundation for flexible and open systems. It underlies some of the Internet's most successful e-business sites, and some of the world's most complex and demanding enterprise information systems.

Need for high-performance systems

Orbix is a CORBA development platform for building high-performance systems. Its modular architecture supports the most demanding needs for scalability, performance, and deployment flexibility. The Orbix architecture is also language-independent, so you can implement Orbix applications in COBOL, PL/I, C++, or Java that interoperate via the standard IIOP protocol with applications built on any CORBA-compliant technology.

Open standard solution

CORBA is an open, standard solution for distributed object systems. You can use CORBA to describe your enterprise system in object-oriented terms, regardless of the platforms and technologies used to implement its different parts. CORBA objects communicate directly across a network using standard protocols, regardless of the programming languages used to create objects or the operating systems and platforms on which the objects run.

Widely available solution

CORBA solutions are available for every common environment and are used to integrate applications written in C, C++, Java, Ada, Smalltalk, COBOL, and PL/I running on embedded systems, PCs, UNIX hosts, and mainframes. CORBA objects running in these environments can cooperate seamlessly. Through COMet, Micro Focus's dynamic bridge between CORBA and COM, they can also interoperate with COM objects. CORBA offers an extensive infrastructure that supports all the features required by distributed business objects. This infrastructure includes important distributed services, such as transactions, messaging, and security.

CORBA Objects

Nature of abstract CORBA objects

CORBA objects are abstract objects in a CORBA system that provide distributed object capability between applications in a network. Figure 1 shows that any part of a CORBA system can refer to the abstract CORBA object, but the object is only implemented in one place and time on some server of the system.

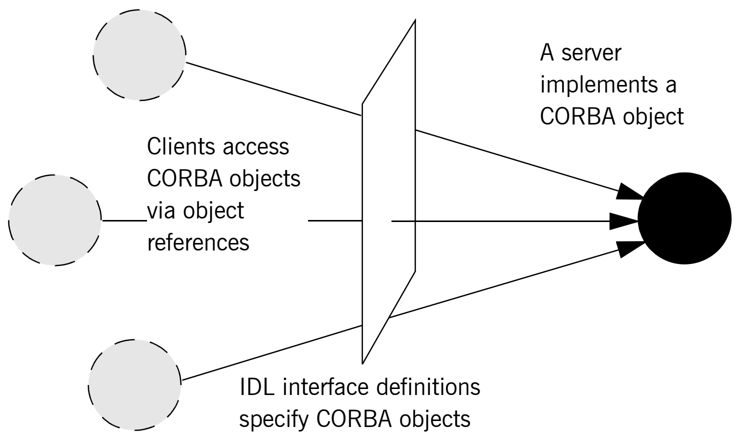

Figure 1: *The Nature of Abstract CORBA Objects*

Object references

An *object reference* is used to identify, locate, and address a CORBA object. Clients use an object reference to invoke requests on a CORBA object. CORBA objects can be implemented by servers in any supported programming language, such as COBOL, PL/I, C++, or Java.

IDL interfaces

Although CORBA objects are implemented using standard programming languages, each CORBA object has a clearly-defined interface, specified in the *CORBA Interface Definition Language (IDL)*. The *interface definition* specifies which member functions, data types, attributes, and exceptions are available to a client, without making any assumptions about an object's implementation.

Advantages of IDL

To call member functions on a CORBA object, a client programmer needs only to refer to the object's interface definition. Clients use their normal programming language syntax to call the member functions of a CORBA object. A client does not need to know which programming language implements the object, the object's location on the network, or the operating system in which the object exists.

Using an IDL interface to separate an object's use from its implementation has several advantages. For example, it means that you can change the programming language in which an object is implemented without affecting the clients that access the object. It also means that you can make existing objects available across a distributed network.

Object Request Broker

Overview

CORBA defines a standard architecture for object request brokers (ORB). An ORB is a software component that mediates the transfer of messages from a program to an object located on a remote network host. The ORB hides the underlying complexity of network communications from the programmer. With a few calls to an ORB's application programming interface (API), servers can make CORBA objects available to client programs in your network.

Role of an ORB

An ORB lets you create standard software objects whose member functions can be invoked by *client* programs located anywhere in your network. A program that contains instances of CORBA objects is often known as a *server*. However, the same program can serve at different times as a client and a server. For example, a server program might itself invoke calls on other server programs, and so relate to them as a client.

When a client invokes a member function on a CORBA object, the ORB intercepts the function call. As shown in Figure 2 on page 6, the ORB redirects the function call across the network to the target object. The ORB then collects results from the function call and returns these to the client.

Graphical overview of ORB role

Figure 2 provides a graphical overview of the role of the ORB in distributed network communications.

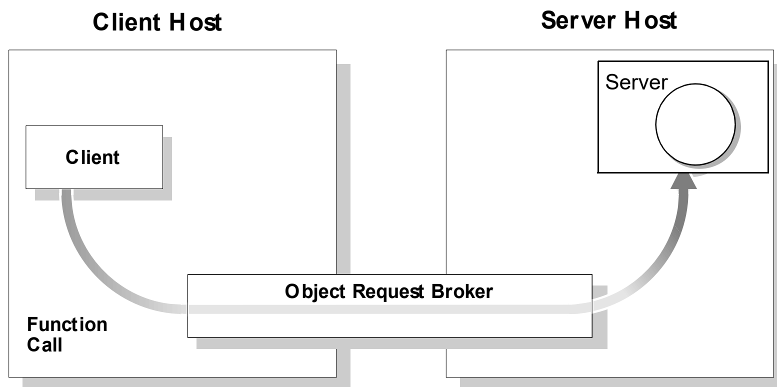

Figure 2: *The Object Request Broker*

CORBA Application Basics

Developing application interfaces

You start developing a CORBA application by defining interfaces to objects in your system in CORBA IDL. You compile these interfaces with an IDL compiler. An IDL compiler can generate COBOL, PL/I, C++, or Java from IDL definitions. Generated COBOL and PL/I consists of *server skeleton code*, which you use to implement CORBA objects.

Client invocations on CORBA objects

When an Orbix COBOL client on z/OS calls a member function on a CORBA object on another platform, the call is transferred through the COBOL runtime to the ORB. (The client invokes on object references that it obtains from the server process.) The ORB then passes the function call to the server.

When a CORBA client on another platform calls a member function on an Orbix COBOL server object on OS390, the ORB passes the function call through the COBOL runtime and then through the server skeleton code to the target object.

Orbix Plug-In Design

Overview

Orbix has a modular *plug-in* architecture. The ORB core supports abstract CORBA types and provides a plug-in framework. Support for concrete features like specific network protocols, encryption mechanisms, and database storage is packaged into plug-ins that can be loaded into the ORB, based on runtime configuration settings.

Plug-ins

A plug-in is a code library that can be loaded into an Orbix application at runtime. A plug-in can contain any type of code; typically, it contains objects that register themselves with the ORB runtimes to add functionality.

Plug-ins can be linked directly with an application, loaded when an application starts up, or loaded on-demand while the application is running. This gives you the flexibility to choose precisely those ORB features that you actually need. Moreover, you can develop new features such as protocol support for direct ATM or HTTPNG. Because ORB features are *configured* into the application rather than *compiled* in, you can change your choices as your needs change without rewriting or recompiling applications.

For example, an application that uses the standard IIOP protocol can be reconfigured to use the secure SSL protocol simply by configuring a different transport plug-in. There is no particular transport inherent to the ORB core; you simply load the transport set that suits your application best. This architecture makes it easy to support additional transports in the future such as multicast or special purpose network protocols.

ORB core

The ORB core presents a uniform programming interface to the developer: *everything is a CORBA object*. This means that everything appears to be a local COBOL, PL/I, C++, or Java object within the process, depending on which language you are using. In fact it might be a local object, or a remote object reached by some network protocol. It is the ORB's job to get application requests to the right objects no matter where they are located.

To do its job, the ORB loads a collection of plug-ins as specified by ORB configuration settings—either on startup or on demand—as they are needed by the application. For remote objects, the ORB intercepts local function calls and turns them into CORBA *requests* that can be dispatched to a remote object across the network via the standard IIOP protocol.

Orbix Application Deployment

Overview

Orbix provides a rich deployment environment designed for high scalability. You can create a *location domain* that spans any number of hosts across a network, and can be dynamically extended with new hosts. Centralized domain management allows servers and their objects to move among hosts within the domain without disturbing clients that use those objects. Orbix supports load balancing across object groups. A *configuration domain* provides the central control of configuration for an entire distributed application.

Orbix offers a rich deployment environment that lets you structure and control enterprise-wide distributed applications. Orbix provides central control of all applications within a common domain.

In this section

This section discusses the following topics:

Location Domains

Overview

A location domain is a collection of servers under the control of a single locator daemon. An Orbix location domain consists of two components: a *locator daemon* and a *node daemon*.

> **Note:** See the *CORBA Administrator's Guide* for more details about these.

Locator daemon

The locator daemon can manage servers on any number of hosts across a network. The locator daemon automatically activates remote servers through a stateless activator daemon that runs on the remote host.

The locator daemon also maintains the implementation repository, which is a database of available servers. The implementation repository keeps track of the servers available in a system and the hosts they run on. It also provides a central forwarding point for client requests. By combining these two functions, the locator lets you relocate servers from one host to another without disrupting client request processing. The locator redirects requests to the new location and transparently reconnects clients to the new server instance. Moving a server does not require updates to the naming service, trading service, or any other repository of object references.

The locator can monitor the state of health of servers and redirect clients in the event of a failure, or spread client load by redirecting clients to one of a group of servers.

Node daemon

The node daemon acts as the control point for a single machine in the system. Every machine that will run an application server must be running a node daemon. The node daemon starts, monitors, and manages the application servers running on that machine. The locator daemon relies on the node daemons to start processes and inform it when new processes have become available.

Configuration Domains

Overview

A configuration domain is a collection of applications under common administrative control. A configuration domain can contain multiple location domains. During development, or for small-scale deployment, configuration can be stored in an ASCII text file, which is edited directly.

Plug-in design

The configuration mechanism is loaded as a plug-in, so future configuration systems can be extended to load configuration from any source such as example HTTP or third-party configuration systems.

Getting Started in Batch

This chapter introduces batch application programming with Orbix, by showing how to use Orbix to develop a simple distributed application that features a COBOL client and server, each running in its own region.

In this chapter

This chapter discusses the following topics:

Note: The example provided in this chapter does not reflect a real-world scenario that requires Orbix Mainframe, because the supplied client and server are written in COBOL and running on z/OS. The example is supplied to help you quickly familiarize with the concepts of developing a batch COBOL application with Orbix.

Overview and Setup Requirements

Introduction

This section provides an overview of the main steps involved in creating an Orbix COBOL application. It describes important steps that you must perform before you begin. It also introduces the supplied `SIMPLE` demonstration, and outlines where you can find the various source code and JCL elements for it.

Steps to create an application

The main steps to create an Orbix COBOL application are:

Step	Action
1	"Developing the Application Interfaces" on page 19.
2	"Developing the Server" on page 25.
3	"Developing the Client" on page 35.

This chapter describes in detail how to perform each of these steps.

The Simple demonstration

This chapter describes how to develop a simple client-server application that consists of:

- An Orbix COBOL server that implements a simple persistent POA-based server.
- An Orbix COBOL client that uses the clearly defined object interface, `SimpleObject`, to communicate with the server.

The client and server use the Internet Inter-ORB Protocol (IIOP), which runs over TCP/IP, to communicate. As already stated, the `SIMPLE` demonstration is not meant to reflect a real-world scenario requiring Orbix Mainframe, because the client and server are written in the same language and running on the same platform.

The demonstration server

The server accepts and processes requests from the client across the network. It is a batch server that runs in its own region.

See "Location of supplied code and JCL" on page 15 for details of where you can find an example of the supplied server. See "Developing the Server" on page 25 for more details of how to develop the server.

The demonstration client

The client runs in its own region and accesses and requests data from the server. When the client invokes a remote operation, a request message is sent from the client to the server. When the operation has completed, a reply message is sent back to the client. This completes a single remote CORBA invocation.

See "Location of supplied code and JCL" on page 15 for details of where you can find an example of the supplied client. See "Developing the Client" on page 35 for more details of how to develop the client.

Location of supplied code and JCL

All the source code and JCL components needed to create and run the batch `SIMPLE` demonstration have been provided with your installation. Apart from site-specific changes to some JCL, these do not require editing.

Table 1 provides a summary of the supplied code elements and JCL components that are relevant to the batch `SIMPLE` demonstration (where *orbixhlq* represents your installation's high-level qualifier).

Table 1: *Supplied Code and JCL (Sheet 1 of 2)*

Location	Description
orbixhlq.DEMO.IDL(SIMPLE)	This is the supplied IDL.
orbixhlq.DEMO.CBL.SRC(SIMPLESV)	This is the source code for the batch server mainline module.
orbixhlq.DEMO.CBL.SRC(SIMPLES)	This is the source code for the batch server implementation module.
orbixhlq.DEMO.CBL.SRC(SIMPLECL)	This is the source code for the client module.
orbixhlq.JCLLIB(LOCATOR)	This JCL runs the Orbix locator daemon.
orbixhlq.JCLLIB(NODEDAEM)	This JCL runs the Orbix node daemon.

Table 1: *Supplied Code and JCL (Sheet 2 of 2)*

Location	Description
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLIDL)	This JCL runs the Orbix IDL compiler, to generate COBOL source and copybooks for the batch server. The `-S` and `-Z` compiler arguments, which generate server mainline and server implementation code respectively, are disabled by default in this JCL.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLECB)	This JCL compiles the client module to create the `SIMPLE` client program.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPBDCB)	This JCL compiles the client module to create the SIMPLE client program when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLESB)	This JCL compiles and links the batch server mainline and batch server implementation modules to create the `SIMPLE` server program.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPBDSB)	This JCL compiles and links the batch server mainline and batch server implementation modules to create the SIMPLE server program when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPLESV)	This JCL runs the server.
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPBDSV)	This JCL runs the server when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLECL)	This JCL runs the client.
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPBDCL)	This JCL runs the client when using a COBOL compiler later than version 4.2.

Note: Other code elements and JCL components are provided for the IMS and CICS versions of the `SIMPLE` demonstration. See "Getting Started in IMS" on page 49 and "Getting Started in CICS" on page 125 for more details of these.

Supplied copybooks

Table 2 provides a summary in alphabetic order of the various copybooks supplied with your product installation that are relevant to batch. Again, *orbixhlq* represents your installation's high-level qualifier.

Table 2: *Supplied Copybooks (Sheet 1 of 2)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(CHKERRS)	This contains a COBOL paragraph that can be called both by clients and servers to check if a system exception has occurred, and to report that system exception.
orbixhlq.INCLUDE.COPYLIB(CHKFILE)	This is used both by clients and servers. It is used for file handling error checking.
orbixhlq.INCLUDE.COPYLIB(CORBA)	This is used both by clients and servers. It contains various Orbix COBOL definitions, such as REQUEST-INFO used by the COAREQ function, and ORBIX-STATUS-INFORMATION which is used to register and report system exceptions raised by the COBOL runtime.
orbixhlq.INCLUDE.COPYLIB(CORBATYP)	This is used both by clients and servers. It contains the COBOL typecode representations for IDL basic types.
orbixhlq.INCLUDE.COPYLIB(IORFD)	This is used both by clients and servers. It contains the COBOL FD statement entry for file processing, for use with the COPY…REPLACING statement.
orbixhlq.INCLUDE.COPYLIB(IORSLCT)	This is used both by clients and servers. It contains the COBOL SELECT statement entry for file processing, for use with the COPY…REPLACING statement.
orbixhlq.INCLUDE.COPYLIB(PROCPARM)	This is used both by clients and servers. It contains the appropriate definitions for a COBOL program to accept parameters from the JCL for use with the ORBARGS API (that is, the argument-string parameter).

Table 2: *Supplied Copybooks (Sheet 2 of 2)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(WSURLSTR)	This is relevant to clients only. It contains a COBOL representation of the corbaloc URL IIOP string format. A client can call STRTOOBJ to convert the URL into an object reference. See "STRTOOBJ" on page 514 for more details.
orbixhlq.DEMO.CBL.COPYLIB	This PDS is used to store all batch copybooks generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. It also contains copybooks with Working Storage data definitions and Procedure Division paragraphs for use with the bank, naming, and nested sequences demonstrations.

Checking JCL components

When creating the SIMPLE application, check that each step involved within the separate JCL components completes with a condition code of zero. If the condition codes are not zero, establish the point and cause of failure. The most likely cause is the site-specific JCL changes required for the compilers. Ensure that each high-level qualifier throughout the JCL reflects your installation.

Developing the Application Interfaces

Overview

This section describes the steps you must follow to develop the IDL interfaces for your application. It first describes how to define the IDL interfaces for the objects in your system. It then describes how to generate COBOL source and copybooks from IDL interfaces, and provides a description of the members generated from the supplied `SimpleObject` interface.

Steps to develop application interfaces

The steps to develop the interfaces to your application are:

Step	Action
1	Define public IDL interfaces to the objects required in your system. See "Defining IDL Interfaces" on page 20.
2	Use the `ORXCOPY` utility to copy your IDL files to z/OS (if necessary). See "ORXCOPY Utility" on page 553.
3	Use the Orbix IDL compiler to generate COBOL source code and copybooks from the defined IDL. See "Generating COBOL Source and Copybooks" on page 21.

Defining IDL Interfaces

Defining the IDL

The first step in writing an Orbix program is to define the IDL interfaces for the objects required in your system. The following is an example of the IDL for the `SimpleObject` interface that is supplied in *orbixhlq*.DEMO.IDL(SIMPLE):

```
// IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

Explanation of the IDL

The preceding IDL declares a `SimpleObject` interface that is scoped (that is, contained) within the `Simple` module. This interface exposes a single `call_me()` operation. This IDL definition provides a language-neutral interface to the CORBA `Simple::SimpleObject` type.

How the demonstration uses this IDL

For the purposes of this example, the `SimpleObject` CORBA object is implemented in COBOL in the supplied `SIMPLES` server application. The server application creates a persistent server object of the `SimpleObject` type, and publishes its object reference to a PDS member. The client application must then locate the `SimpleObject` object by reading the interoperable object reference (IOR) from the relevant PDS member. The client invokes the `call_me()` operation on the `SimpleObject` object, and then exits.

Generating COBOL Source and Copybooks

The Orbix IDL compiler

You can use the Orbix IDL compiler to generate COBOL source and copybooks from IDL definitions.

> **Note:** If your IDL files are not already contained in z/OS data sets, you must copy them to z/OS before you proceed. You can use the ORXCOPY utility to do this. If necessary, see "ORXCOPY Utility" on page 553 for more details.

Orbix IDL compiler configuration

The Orbix IDL compiler uses the Orbix configuration member for its settings. The SIMPLIDL JCL that runs the compiler uses the configuration member *orbixhlq*.CONFIG(IDL). See "Orbix IDL Compiler" on page 315 for more details.

Running the Orbix IDL compiler

The COBOL source for the batch server demonstration described in this chapter is generated in the first step of the following job:

```
orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLIDL)
```

Generated source code members

Table 3 shows the server source code members that the Orbix IDL compiler generates, based on the defined IDL.

Table 3: *Generated Server Source Code Members*

Member	JCL Keyword Parameter	Description
*idlmembername*S	IMPL	This is the server implementation source code member. It contains stub paragraphs for all the callable operations. The is only generated if you specify the -Z argument with the IDL compiler.

Table 3: *Generated Server Source Code Members*

Member	JCL Keyword Parameter	Description
*idlmembername*SV	IMPL	This is server mainline source code member. This is only generated if you specify the -S argument with the IDL compiler.

Note: For the purposes of this example, the SIMPLES server implementation and SIMPLESV server mainline are already provided in your product installation. Therefore, the IDL compiler arguments that are used to generate them are not specified in the supplied SIMPLIDL JCL. See "Orbix IDL Compiler" on page 315 for more details of the IDL compiler arguments used to generate server source code.

Generated COBOL copybooks

Table 4 shows the COBOL copybooks that the Orbix IDL compiler generates, based on the defined IDL.

Table 4: *Generated COBOL Copybooks*

Copybook	JCL Keyword Parameter	Description
idlmembername	COPYLIB	This copybook contains data definitions that are used for working with operation parameters and return values for each interface defined in the IDL member. The name for this copybook does not take a suffix.

Table 4: *Generated COBOL Copybooks*

Copybook	JCL Keyword Parameter	Description
*idlmembername*X	COPYLIB	This copybook contains data definitions that are used by the COBOL runtime to support the interfaces defined in the IDL member. This copybook is automatically included in the *idlmembername* copybook.
*idlmembername*D	COPYLIB	This copybook contains procedural code for performing the correct paragraph for the requested operation. This copybook is automatically included in the *idlmembername*S source code member.

How IDL maps to COBOL copybooks

Each IDL interface maps to a group of COBOL data definitions. There is one definition for each IDL operation. A definition contains each of the parameters for the relevant IDL operation in their corresponding COBOL representation. See "IDL-to-COBOL Mapping" on page 237 for details of how IDL types map to COBOL.

Attributes map to two operations (`get` and `set`), and readonly attributes map to a single `get` operation.

Member name restrictions

Generated source code member and copybook names are based on the IDL member name. If the IDL member name exceeds six characters, the Orbix IDL compiler uses only the first six characters of the IDL member name when generating the other member names. This allows space for appending the two-character `SV` suffix to the name for the server mainline member, while allowing it to adhere to the eight-character maximum size limit for z/OS member names. Consequently, all other member names also use only the first six characters of the IDL member name, followed by their individual suffixes, as appropriate.

Location of demonstration copybooks

You can find examples of the copybooks generated for the `SIMPLE` demonstration in the following locations:

- `*orbixhlq*.DEMO.CBL.COPYLIB(SIMPLE)`
- `*orbixhlq*.DEMO.CBL.COPYLIB(SIMPLEX)`
- `*orbixhlq*.DEMO.CBL.COPYLIB(SIMPLED)`

Note: These copybooks are not shipped with your product installation. They are generated when you run the supplied `SIMPLIDL` JCL, to run the Orbix IDL compiler.

Developing the Server

Overview

This section describes the steps you must follow to develop the batch server executable for your application.

Steps to develop the server

The steps to develop the server application are:

Step	Action
1	"Writing the Server Implementation" on page 26
2	"Writing the Server Mainline" on page 29
3	"Building the Server" on page 34.

Writing the Server Implementation

The server implementation program

You must implement the server interface by writing a COBOL program that implements each operation in the *`idlmembername`* copybook. For the purposes of this example, you must write a COBOL program that implements each operation in the `SIMPLE` copybook. When you specify the `-Z` argument with the Orbix IDL compiler in this case, it generates a skeleton program called `SIMPLES`, which is a useful starting point.

Example of the SIMPLES program

The following is an example of the batch `SIMPLES` program:

Example 1: *The Batch SIMPLES Demonstration (Sheet 1 of 2)*

```
****************************************************************
* Identification Division
****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID.             SIMPLES.

ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
COPY SIMPLE.
COPY CORBA.

01 WS-INTERFACE-NAME                    PICTURE X(30).
01 WS-INTERFACE-NAME-LENGTH             PICTURE 9(09) BINARY
                                        VALUE 30.

****************************************************************
* Procedure Division
****************************************************************
PROCEDURE DIVISION.

1       ENTRY "DISPATCH".

2       CALL "COAREQ"    USING REQUEST-INFO.
        SET WS-COAREQ TO TRUE.
        PERFORM CHECK-STATUS.
```

Example 1: *The Batch SIMPLES Demonstration (Sheet 2 of 2)*

```
3  * Resolve the pointer reference to the interface name which is
   * the fully scoped interface name
   * Note make sure it can handle the max interface name length
         CALL "STRGET"    USING INTERFACE-NAME
                                WS-INTERFACE-NAME-LENGTH
                                WS-INTERFACE-NAME.
         SET WS-STRGET TO TRUE.
         PERFORM CHECK-STATUS.


   ****************************************************************
   * Interface(s)  evaluation:
   ****************************************************************
         MOVE SPACES TO SIMPLE-SIMPLEOBJECT-OPERATION.

         EVALUATE WS-INTERFACE-NAME
         WHEN 'IDL:Simple/SimpleObject:1.0'

4  * Resolve the pointer reference to the operation information
         CALL "STRGET" USING OPERATION-NAME
                             SIMPLE-S-3497-OPERATION-LENGTH
                             SIMPLE-SIMPLEOBJECT-OPERATION
         SET WS-STRGET TO TRUE
         PERFORM CHECK-STATUS
         DISPLAY  "Simple::" SIMPLE-SIMPLEOBJECT-OPERATION
                    "invoked"
         END-EVALUATE.

5  COPY SIMPLED.

         GOBACK.

6  DO-SIMPLE-SIMPLEOBJECT-CALL-ME.
         CALL "COAGET"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
         SET WS-COAGET TO TRUE.
         PERFORM CHECK-STATUS.

         CALL "COAPUT"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
         SET WS-COAPUT TO TRUE.
         PERFORM CHECK-STATUS.

   ****************************************************************
   * Check Errors Copybook
   ****************************************************************
   COPY CHKERRS.
```

Explanation of the batch SIMPLES program

The `SIMPLES` program can be explained as follows:

1. The `DISPATCH` logic is automatically coded for you, and the bulk of the code is contained in the `SIMPLED` copybook. When an incoming request arrives from the network, it is processed by the ORB and a call is made to the `DISPATCH` entry point.
2. `COAREQ` is called to provide information about the current invocation request, which is held in the `REQUEST-INFO` block that is contained in the `CORBA` copybook.

   `COAREQ` is called once for each operation invocation—after a request has been dispatched to the server, but before any calls are made to access the parameter values.
3. `STRGET` is called to copy the characters in the unbounded string pointer for the interface name to the string item representing the fully scoped interface name.
4. `STRGET` is called again to copy the characters in the unbounded string pointer for the operation name to the string item representing the operation name.
5. The procedural code used to perform the correct paragraph for the requested operation is copied into the program from the `SIMPLED` copybook.
6. Each operation has skeleton code, with appropriate calls to `COAPUT` and `COAGET` to copy values to and from the COBOL structures for that operation's argument list. You must provide a correct implementation for each operation. You must call `COAGET` and `COAPUT`, even if your operation takes no parameters and returns no data. You can simply pass in a dummy area as the parameter list.

Note: The supplied `SIMPLES` program is only a suggested way of implementing an interface. It is not necessary to have all operations implemented in the same COBOL program.

Location of the batch SIMPLES program

You can find a complete version of the batch `SIMPLES` server implementation program in `*orbixhlq*.DEMO.CBL.SRC(SIMPLES)`.

Writing the Server Mainline

The server mainline program

The next step is to write the server mainline program in which to run the server implementation. For the purposes of this example, when you specify the `-S` argument with the Orbix IDL compiler, it generates a program called `SIMPLESV`, which contains the server mainline code.

Example of the batch SIMPLESV program

The following is an example of the batch `SIMPLESV` program:

Example 2: *The Batch SIMPLESV Demonstration (Sheet 1 of 4)*

```
IDENTIFICATION DIVISION.
PROGRAM-ID.          SIMPLESV.
ENVIRONMENT DIVISION.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    COPY IORSLCT REPLACING
        "X-IOR" BY SIMPLE-SIMPLEOBJECT-IOR
        "X-IORFILE" BY "IORFILE"
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.
DATA DIVISION.
FILE SECTION.

    COPY IORFD REPLACING
        "X-IOR" BY SIMPLE-SIMPLEOBJECT-IOR
        "X-REC" BY SIMPLE-SIMPLEOBJECT-REC.

WORKING-STORAGE SECTION.

COPY SIMPLE.
COPY CORBA.

01 ARG-LIST                             PICTURE X(80)
                                        VALUE SPACES.
01 ARG-LIST-LEN                         PICTURE 9(09) BINARY
                                        VALUE 0.
01 ORB-NAME                             PICTURE X(10)
                                        VALUE "simple_orb".
01 ORB-NAME-LEN                         PICTURE 9(09) BINARY
                                        VALUE 10.
01 SERVER-NAME                          PICTURE X(18)
                                      VALUE "simple_persistent ".
```

Example 2: *The Batch SIMPLESV Demonstration (Sheet 2 of 4)*

```
01 SERVER-NAME-LEN                          PICTURE 9(09) BINARY
                                            VALUE 17.
01 INTERFACE-LIST.
   03 FILLER                                PICTURE X(28)
       VALUE "IDL:Simple/SimpleObject:1.0 ".
01 INTERFACE-NAMES-ARRAY REDEFINES INTERFACE-LIST.
   03 INTERFACE-NAME OCCURS 1 TIMES         PICTURE X(28).

01 OBJECT-ID-LIST.
   03 FILLER                                PICTURE X(17)
                                          VALUE "my_simple_object ".
01 OBJECT-ID-ARRAY REDEFINES OBJECT-ID-LIST.
   03 OBJECT-IDENTIFIER OCCURS 1 TIMES      PICTURE X(17).

01 IOR-REC-LEN                              PICTURE 9(09) BINARY
                                            VALUE 2048.
01 IOR-REC-PTR                              POINTER.
                                            VALUE NULL.


****************************************************************
* Status and Obj values for the Interface(s)
****************************************************************
01 SIMPLE-SIMPLEOBJECT-IOR-STAT              PICTURE 9(02).
01 SIMPLE-SIMPLEOBJECT-OBJ                   POINTER
                                             VALUE NULL.

COPY PROCPARM.

INIT.
```

1
```
    CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.

    DISPLAY "Initializing the ORB".
```

2
```
    CALL "ORBARGS"   USING ARG-LIST
                           ARG-LIST-LEN
                           ORB-NAME
                           ORB-NAME-LEN.
    SET WS-ORBARGS TO TRUE.
    PERFORM CHECK-STATUS.
```

3
```
    CALL "ORBSRVR"   USING SERVER-NAME
                           SERVER-NAME-LEN.
    SET WS-ORBSRVR TO TRUE.
```

Example 2: *The Batch SIMPLESV Demonstration (Sheet 3 of 4)*

```
    PERFORM CHECK-STATUS.

****************************************************************
* Interface Section Block
****************************************************************

*  Generating IOR for interface Simple/SimpleObject
    DISPLAY "Registering the Interface".

4   CALL "ORBREG"    USING SIMPLE-SIMPLEOBJECT-INTERFACE.
    SET WS-ORBREG TO TRUE.

    OPEN OUTPUT SIMPLE-SIMPLEOBJECT-IOR.
    COPY CHKFILE REPLACING
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.

    DISPLAY "Creating the Object".
5   CALL "OBJNEW"    USING SERVER-NAME
                           INTERFACE-NAME
                           OF INTERFACE-NAMES-ARRAY(1)
                           OBJECT-IDENTIFIER
                           OF OBJECT-ID-ARRAY(1)
                           SIMPLE-SIMPLEOBJECT-OBJ.
    SET WS-OBJNEW TO TRUE.
    PERFORM CHECK-STATUS.

6   CALL "OBJTOSTR"  USING SIMPLE-SIMPLEOBJECT-OBJ
                           IOR-REC-PTR.
    SET WS-OBJTOSTR TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "STRGET"    USING IOR-REC-PTR
                           IOR-REC-LEN
                           SIMPLE-SIMPLEOBJECT-REC.
    SET WS-STRGET TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "STRFREE"   USING IOR-REC-PTR.
    SET WS-STRFREE TO TRUE.
    PERFORM CHECK-STATUS.

    DISPLAY "Writing object reference to file".

    WRITE SIMPLE-SIMPLEOBJECT-REC.
```

Example 2: *The Batch SIMPLESV Demonstration (Sheet 4 of 4)*

```
    COPY CHKFILE REPLACING
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.

    CLOSE SIMPLE-SIMPLEOBJECT-IOR.
    COPY CHKFILE REPLACING
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.

    DISPLAY "Giving control to the ORB to process Requests".
7   CALL "COARUN".
    SET WS-COARUN TO TRUE.
    PERFORM CHECK-STATUS.

8   CALL "OBJREL" USING SIMPLE-SIMPLEOBJECT-OBJ.
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

EXIT-PRG.
    STOP RUN.

****************************************************************
* Check Errors Copybook
****************************************************************
COPY CHKERRS.
```

Explanation of the batch SIMPLESV program

The `SIMPLESV` program can be explained as follows:

1. `ORBSTAT` is called to register the `ORBIX-STATUS-INFORMATION` block that is contained in the `CORBA` copybook. Registering the `ORBIX-STATUS-INFORMATION` block allows the COBOL runtime to populate it with exception information, if necessary.
2. `ORBARGS` is called to initialize a connection to the ORB.
3. `ORBSRVR` is called to set the server name.
4. `ORBREG` is called to register the IDL interface, `SimpleObject`, with the Orbix COBOL runtime.
5. `OBJNEW` is called to create a persistent server object of the `SimpleObject` type, with an object ID of `my_simple_object`.
6. `OBJTOSTR` is called to translate the object reference created by `OBJNEW` into a stringified IOR. The stringified IOR is then written to the `IORFILE` member.

7. `COARUN` is called, to enter the `ORB::run` loop, to allow the ORB to receive and process client requests.
8. `OBJREL` is called to ensure that the servant object is released properly.

Building the Server

Location of the JCL

Sample JCL used to compile and link the batch server mainline and server implementation is in `orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLESB)`.

When using a COBOL compiler later than 4.2, use this sample JCL:

`orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPBDSB)`

Resulting load module

When this JCL has successfully executed, it results in a load module that is contained in `orbixhlq.DEMO.CBL.LOADLIB(SIMPLESV)`.

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

`orbixhlq.DEMO.CBL.BD.LOADLIB(SIMPLESV)`

Developing the Client

Overview

This section describes the steps you must follow to develop the client executable for your application.

Note: The Orbix IDL compiler does not generate COBOL client stub code.

Steps to develop the client

The steps to develop the client application are:

Step	Action
1	"Writing the Client" on page 36.
2	"Building the Client" on page 41.

Writing the Client

The client program

The next step is to write the client program, to implement the client. This example uses the supplied `SIMPLECL` client demonstration.

Example of the SIMPLECL program

The following is an example of the `SIMPLECL` program:

Example 3: *The SIMPLECL Demonstration Program (Sheet 1 of 3)*

```
IDENTIFICATION DIVISION.
PROGRAM-ID.                     SIMPLECL.

ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    COPY IORSLCT REPLACING
        "X-IOR" BY SIMPLE-SIMPLEOBJECT-IOR
        "X-IORFILE" BY "IORFILE"
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.
DATA DIVISION.
FILE SECTION.

    COPY IORFD REPLACING
        "X-IOR" BY SIMPLE-SIMPLEOBJECT-IOR
        "X-REC" BY SIMPLE-SIMPLEOBJECT-REC.

WORKING-STORAGE SECTION.

COPY SIMPLE.
COPY CORBA.

01 WS-SIMPLE-IOR                            PICTURE X(2048).
01 SIMPLE-IOR-LENGTH                        PICTURE 9(9) BINARY
                                            VALUE 2048.
01 SIMPLE-SIMPLEOBJECT-IOR-STAT             PICTURE 9(02).
01 SIMPLE-SIMPLEOBJECT-OBJ                  POINTER
                                            VALUE NULL.
01 ARG-LIST                                 PICTURE X(80)
                                            VALUE SPACES.
01 ARG-LIST-LEN                             PICTURE 9(09) BINARY
                                            VALUE 0.
```

Example 3: *The SIMPLECL Demonstration Program (Sheet 2 of 3)*

```
    01 ORB-NAME                         PICTURE X(10)
                                        VALUE "simple_orb".
    01 ORB-NAME-LEN                     PICTURE 9(09) BINARY
                                        VALUE 10.
    01 IOR-REC-PTR                      POINTER
                                        VALUE NULL.
    01 IOR-REC-LEN                      PICTURE 9(09) BINARY
                                        VALUE 2048.

    COPY PROCPARM.
1       CALL "ORBSTAT" USING ORBIX-STATUS-INFORMATION.

    *  ORB initialization
        DISPLAY "Initializing the ORB".
2       CALL "ORBARGS"   USING ARG-LIST
                               ARG-LIST-LEN
                               ORB-NAME
                               ORB-NAME-LEN.
        SET WS-ORBARGS TO TRUE.
        PERFORM CHECK-STATUS.

    * Register interface TypeTest
        DISPLAY "Registering the Interface".
3       CALL  "ORBREG"   USING SIMPLE-SIMPLEOBJECT-INTERFACE.
        SET WS-ORBREG TO TRUE.
        PERFORM CHECK-STATUS.

    *
4   **  Read in the IOR from a file which has been populated
    **  by the server program.
    *
        OPEN INPUT SIMPLE-SIMPLEOBJECT-IOR.
        COPY CHKFILE REPLACING
            "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.

        DISPLAY "Reading object reference from file".
        READ SIMPLE-SIMPLEOBJECT-IOR.
        COPY CHKFILE REPLACING
            "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.

        MOVE SIMPLE-SIMPLEOBJECT-REC TO WS-SIMPLE-IOR.

    * IOR Record read successfully
        CLOSE SIMPLE-SIMPLEOBJECT-IOR.
        COPY CHKFILE REPLACING
```

Example 3: *The SIMPLECL Demonstration Program (Sheet 3 of 3)*

```
        "X-IOR-STAT" BY SIMPLE-SIMPLEOBJECT-IOR-STAT.
* Set the COBOL pointer to point to the IOR string
5     CALL "STRSET"    USING IOR-REC-PTR
                             IOR-REC-LEN
                             WS-SIMPLE-IOR.
    SET WS-STRSET TO TRUE.
    PERFORM CHECK-STATUS.

* Obtain object reference from the IOR
6     CALL "STRTOOBJ"  USING IOR-REC-PTR
                             SIMPLE-SIMPLEOBJECT-OBJ

    SET WS-STRTOOBJ TO TRUE.
    PERFORM CHECK-STATUS.

* Releasing the memory
    CALL "STRFREE"  USING IOR-REC-PTR.
    SET WS-STRFREE TO TRUE.
    PERFORM CHECK-STATUS.

    SET SIMPLE-SIMPLEOBJECT-CALL-ME  TO TRUE
    DISPLAY "invoking Simple::" SIMPLE-SIMPLEOBJECT-OPERATION.


7     CALL "ORBEXEC"   USING SIMPLE-SIMPLEOBJECT-OBJ
                             SIMPLE-SIMPLEOBJECT-OPERATION
                             SIMPLE-SIMPLEOBJECT-70FE-ARGS
                             SIMPLE-USER-EXCEPTIONS.
    SET WS-ORBEXEC TO TRUE.
    PERFORM CHECK-STATUS.

8     CALL "OBJREL" USING SIMPLE-SIMPLEOBJECT-OBJ.
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

    DISPLAY "Simple demo complete.".

EXIT-PRG.
*========.
STOP RUN.

****************************************************************
* Check Errors Copybook
****************************************************************
       COPY CHKERRS.
```

Explanation of the SIMPLECL program

The `SIMPLECL` program can be explained as follows:

1. `ORBSTAT` is called to register the `ORBIX-STATUS-INFORMATION` block that is contained in the `CORBA` copybook. Registering the `ORBIX-STATUS-INFORMATION` block allows the COBOL runtime to populate it with exception information, if necessary.

   You can use the `ORBIX-STATUS-INFORMATION` data item (in the `CORBA` copybook) to check the status of any Orbix call. The `EXCEPTION-NUMBER` numeric data item is important in this case. If this item is `0`, it means the call was successful. Otherwise, `EXCEPTION-NUMBER` holds the system exception number that occurred. You should test this data item after any Orbix call.
2. `ORBARGS` is called to initialize a connection to the ORB.
3. `ORBREG` is called to register the IDL interface with the Orbix COBOL runtime.
4. The client reads the stringified object reference for the object from the PDS member that has been populated by the server. For the purposes of this example, the IOR member is contained in *`orbixhlq`*`.DEMO.IORS(SIMPLE)`.
5. `STRSET` is called to create an unbounded string to which the stringified object reference is copied.
6. `STRTOOBJ` is called to create an object reference to the server object that is represented by the IOR. This must be done to allow operation invocations on the server. The `STRTOOBJ` call takes an interoperable stringified object reference and produces an object reference pointer. This pointer is used in all method invocations. See the *CORBA Programmer's Reference, C++* for more details about stringified object references
7. After the object reference is created, `ORBEXEC` is called to invoke operations on the server object represented by that object reference. You must pass the object reference, the operation name, the argument description packet, and the user exception buffer. The operation name must have at least one trailing space. The generated operation condition names found in the `SIMPLE` copybook already handle this.

The same argument description is used by the server, and is found in the `SIMPLE` copybook. For example, see *orbixhlq*.DEMO.CBL.COPYLIB(SIMPLE).

8. `OBJREL` is called to ensure that the servant object is released properly.

Location of the SIMPLECL program

You can find a complete version of the `SIMPLECL` client program in *orbixhlq*.DEMO.CBL.SRC(SIMPLECL).

Building the Client

Location of the JCL

Sample JCL used to compile and link the client can be found in the third step of `orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPLECB)`.

When using a COBOL compiler later than 4.2, use this sample JCL:

`orbixhlq.DEMO.CBL.BLD.JCLLIB(SIMPBDCB)`

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in `orbixhlq.DEMO.CBL.LOADLIB(SIMPLECL)`.

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

`orbixhlq.DEMO.CBL.BD.LOADLIB(SIMPLECL)`

Running the Application

Introduction

This section describes the steps you must follow to run your application. It also provides an example of the output produced by the client and server.

Note: This example involves running a COBOL client and COBOL server. You could, however, choose to run a COBOL server and a C++ client, or a COBOL client and a C++ server. Substitution of the appropriate JCL is all that is required in the following steps to mix clients and servers in different languages.

Steps to run the application

The steps to run the application are:

Step	Action
1	"Starting the Orbix Locator Daemon" on page 43 (if it has not already been started).
2	"Starting the Orbix Node Daemon" on page 44 (if it has not already been started).
3	"Running the Server and Client" on page 45.

Starting the Orbix Locator Daemon

Overview

An Orbix locator daemon must be running on the server's location domain before you try to run your application. The Orbix locator daemon is a program that implements several components of the ORB, including the Implementation Repository. The locator runs in its own address space on the server host, and provides services to the client and server, both of which need to communicate with it.

When you start the Orbix locator daemon, it appears as an active job waiting for requests. See the *CORBA Administrator's Guide* for more details about the locator daemon.

JCL to start the Orbix locator daemon

If the Orbix locator daemon is not already running, you can use the JCL in `orbixhlq.JCLLIB(LOCATOR)` to start it.

Locator daemon configuration

The Orbix locator daemon uses the Orbix configuration member for its settings. The JCL that you use to start the locator daemon uses the configuration member `orbixhlq.CONFIG(DEFAULT@)`.

Starting the Orbix Node Daemon

Overview

An Orbix node daemon must be running on the server's location domain before you try to run your application. The node daemon acts as the control point for a single machine in the system. Every machine that will run an application server must be running a node daemon. The node daemon starts, monitors, and manages the application servers running on that machine. The locator daemon relies on the node daemons to start processes and inform it when new processes have become available.

When you start the Orbix node daemon, it appears as an active job waiting for requests. See the *CORBA Administrator's Guide* for more details about the node daemon.

JCL to start the Orbix node daemon

If the Orbix node daemon is not already running, you can use the JCL in `orbixhlq.JCLLIB(NODEDAEM)` to start it.

Node daemon configuration

The Orbix node daemon uses the Orbix configuration member for its settings. The JCL that you use to start the node daemon uses the configuration member `orbixhlq.CONFIG(DEFAULT@)`.

Running the Server and Client

Overview

This section describes how to run the SIMPLE demonstration.

JCL to run the server

To run the supplied SIMPLESV server application, use the following JCL:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPLESV)
```

When using a COBOL compiler later than 4.2, use this sample JCL:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPBDSV)
```

Note: You can use the z/OS STOP operator command to stop the server.

IOR member for the server

When you run the server, it automatically writes its IOR to a PDS member that is subsequently used by the client. For the purposes of this example, the IOR member is contained in *orbixhlq*.DEMO.IORS(SIMPLE).

JCL to run the client

After you have started the server and made it available to the network, you can use the following JCL to run the supplied SIMPLECL client application:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPLECL)
```

When using a COBOL compiler later than 4.2, use this sample JCL:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPBDCL)
```

Application Output

Server output

The following is an example of the output produced by the server for the `SIMPLE` demonstration:

```
Initializing the ORB
Registering the Interface
Creating the Object
Writing object reference to file
Giving control to the ORB to process Requests
Simple::call_me:IDL:Simple/SimpleObject:1.0 invoked
```

Note: All but the last line of the preceding server output is produced by the `SIMPLESV` server mainline program. The final line is produced by the `SIMPLES` server implementation program.

Client output

The following is an example of the output produced by the `SIMPLECL` client:

```
Initializing the ORB
Registering the Interface
Reading object reference from file
invoking Simple::call_me:IDL:Simple/SimpleObject:1.0
Simple demo complete.
```

Result

If you receive the preceding client and server output, it means you have successfully created an Orbix COBOL client-server batch application.

Application Address Space Layout

Overview

Figure 3 is a graphical overview of the address space layout for an Orbix COBOL application running in batch in a native z/OS environment. This is shown for the purposes of example and is not meant to reflect a real-world scenario requiring Orbix Mainframe.

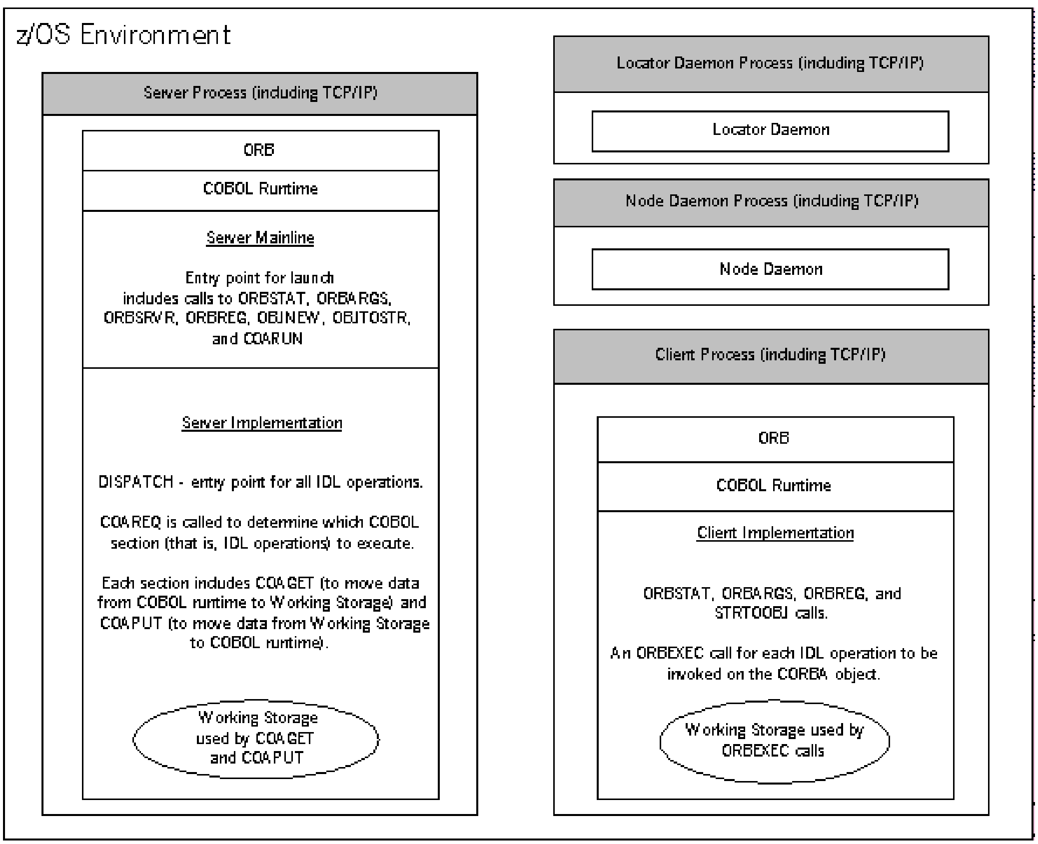

Figure 3: *Address Space Layout for an Orbix COBOL Application*

Explanation of the batch server process

The server-side ORB, COBOL runtime, server mainline (launch entry point) and server implementation (DISPATCH entry point) are linked into a single load module referred to as the "server". The COBOL runtime marshals data to and from the server implementation working storage, which means there is language-specific translation between C++ and COBOL.

The server runs within its own address space. Link the code with a REUSABILITY of REENTRANT.

The server uses the TCP/IP protocol to communicate (through the server-side ORB) with both the client and the locator daemon.

For an example and details of:

- The APIs called by the server mainline, see "Explanation of the batch SIMPLESV program" on page 32 and "API Reference" on page 405.
- The APIs called by the server implementation, see "Explanation of the batch SIMPLES program" on page 28 and "API Reference" on page 405.

Explanation of the daemon processes

The locator daemon and node daemon each runs in its own address space. See "Location Domains" on page 11 for more details of the locator and node daemons.

The locator daemon and node daemon use the TCP/IP protocol to communicate with each other. The locator daemon also uses the TCP/IP protocol to communicate with the server through the server-side ORB.

Explanation of the batch client process

The client-side ORB, COBOL runtime, and client implementation are linked into a single load module referred to as the "client". The client runs within its own address space.

The client (through the client-side ORB) uses TCP/IP to communicate with the server.

For an example and details of the APIs called by the client, see "Explanation of the SIMPLECL program" on page 39 and "API Reference" on page 405.

Getting Started in IMS

This chapter introduces IMS application programming with Orbix, by showing how to use Orbix to develop both an IMS COBOL client and an IMS COBOL server. It also provides details of how to subsequently run the IMS client against a COBOL batch server, and how to run a COBOL batch client against the IMS server. Additionally, this chapter shows how to develop an IMS client that supports two-phase commit transactions.

In this chapter

This chapter discusses the following topics:

Note: The client and server examples provided in this chapter respectively require use of the IMS client and server adapters that are supplied as part of Orbix Mainframe. See the *IMS Adapters Administrator's Guide* for more details about these IMS adapters.

Overview

Introduction

This section provides an overview of the main steps involved in creating the following Orbix COBOL applications:

- IMS server
- IMS client
- IMS two-phase commit client

It also introduces the following COBOL demonstrations that are supplied with your Orbix Mainframe installation, and outlines where you can find the various source code and JCL elements for them:

- `SIMPLE` IMS server
- `SIMPLE` IMS client
- `DATACL` IMS two-phase commit client

Steps to create an application

The main steps to create an Orbix COBOL IMS application are:

1. "Developing the Application Interfaces" on page 59.
2. "Developing the IMS Server" on page 70.
3. "Developing the IMS Client" on page 85.
4. "Developing the IMS Two-Phase Commit Client" on page 97.

For the purposes of illustration this chapter demonstrates how to develop both an Orbix COBOL IMS client and an Orbix COBOL IMS server. It then describes how to run the IMS client and IMS server respectively against a COBOL batch server and a COBOL batch client. Additionally, this chapter describes how to develop an Orbix COBOL two-phase commit IMS client, and run it against two C++ servers. The supplied demonstrations do not reflect real-world scenarios requiring Orbix Mainframe, because the client and server are written in the same language and running on the same platform.

The demonstration IMS server

The Orbix COBOL server developed in this chapter runs in an IMS region. It implements a simple persistent POA-based object. It accepts and processes requests from an Orbix COBOL batch client that uses the object interface, SimpleObject, to communicate with the server via the IMS server adapter. The IMS server uses the Internet Inter-ORB Protocol (IIOP), which runs over TCP/IP, to communicate with the batch client.

The demonstration IMS client

The Orbix COBOL client developed in this chapter runs in an IMS region. It uses the clearly defined object interface, SimpleObject, to access and request data from an Orbix COBOL batch server that implements a simple persistent SimpleObject object. When the client invokes a remote operation, a request message is sent from the client to the server via the client adapter. When the operation has completed, a reply message is sent back to the client again via the client adapter. The IMS client uses IIOP to communicate with the batch server.

The demonstration IMS two-phase commit client

The Orbix COBOL two-phase commit client developed in this chapter runs in an IMS region. It uses the clearly defined object interface, Data, to access and update data from two Orbix C++ batch servers. When the client invokes a remote operation, a request message is sent from the client to one of the servers via the client adapter. When the operation has completed, a reply message is sent back to the client again via the client adapter. The IMS client uses IIOP to communicate with the batch servers.

Supplied code and JCL for IMS application development

All the source code and JCL components needed to create and run the IMS SIMPLE server and client demonstrations have been provided with your installation. Apart from site-specific changes to some JCL, these do not require editing.

Table 5 provides a summary of these code elements and JCL components (where *orbixhlq* represents your installation's high-level qualifier).

Table 5: *Supplied Code and JCL (Sheet 1 of 4)*

Location	Description
orbixhlq.DEMO.IDL(SIMPLE)	This is the supplied IDL for the simple IMS client and server.
orbixhlq.DEMO.IDL(DATA)	This is the supplied IDL for the IMS two-phase commit client.

Table 5: *Supplied Code and JCL (Sheet 2 of 4)*

Location	Description
orbixhlq.DEMO.IMS.CBL.SRC (SIMPLESV)	This is the source code for the IMS server mainline module, which is generated when you run the JCL in *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL). (The IMS server mainline code is not shipped with the product. You must run the SIMPLIDL JCL to generate it.)
orbixhlq.DEMO.IMS.CBL.SRC (SIMPLES)	This is the source code for the IMS server implementation module.
orbixhlq.DEMO.IMS.CBL.SRC (SIMPLECL)	This is the source code for the IMS simple client module.
orbixhlq.DEMO.IMS.CBL.SRC (DATACL)	This is the source code for the IMS two-phase commit client module.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPLIDL)	This JCL runs the Orbix IDL compiler. See "Orbix IDL Compiler" on page 62 for more details of this JCL and how to use it.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPLESB)	This JCL compiles and links the IMS server mainline and IMS server implementation modules to create the SIMPLE server program.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPBDSB)	This JCL compiles and links the IMS server mainline and IMS server implementation modules to create the SIMPLE server program when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPLECB)	This JCL compiles the IMS simple client module to create the SIMPLE client program.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPBDCB)	This JCL compiles the IMS simple client module to create the SIMPLE client program when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (DATACB)	This JCL compiles the IMS two-phase commit client module.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (SIMPLIOR)	This JCL obtains the IMS server's IOR (from the IMS server adapter). A client of the IMS server requires the IMS server's IOR, to locate the server object.

Table 5: *Supplied Code and JCL (Sheet 3 of 4)*

Location	Description
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (UPDTCONF)	This JCL adds the following configuration entry to the configuration member: `initial_references:SimpleObject:reference="IOR…";` This configuration entry specifies the IOR that the IMS client uses to contact the batch server. The IOR that is set as the value for this configuration entry is the IOR that is published in *orbixhlq*.DEMO.IORS(SIMPLE) when you run the batch server. The object reference for the server is represented to the demonstration IMS client as a corbaloc URL string in the form `corbaloc:rir:/SimpleObject`. This form of corbaloc URL string requires the use of the `initial_references:SimpleObject:reference="IOR…"` configuration entry. Other forms of corbaloc URL string can also be used (for example, the IIOP version, as demonstrated in the nested sequences demonstration supplied with your product installation). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (DATAIORS)	This JCL adds the following configuration entries to the configuration member: `initial_references:DataObjectA:reference="IOR…";` `initial_references:DataObjectB:reference="IOR…";` These configuration entries specify the IORs that the IMS two-phase commit client uses to contact the C++ batch servers. The IORs that are set as the value for these configuration entries are the IORs that are published in *orbixhlq*.DEMO.IORS(DATAA) and *orbixhlq*.DEMO.IORS(DATAB) when you run the C++ batch servers. The object references for the servers are represented to the demonstration IMS two-phase commit client as corbaloc URL strings in the form `corbaloc:rir:/DATAObjectA` and `corbaloc:rir:/DATAObjectB`. This form of corbaloc URL string requires the use of the `initial_references:DataObjectA:reference="IOR…"` and `initial_references:DataObjectB:reference="IOR…"` configuration items.

Table 5: *Supplied Code and JCL (Sheet 4 of 4)*

Location	Description
orbixhlq.JCLLIB(IMSCA)	This JCL runs the IMS client adapter.
orbixhlq.JCLLIB(IMSA)	This JCL runs the IMS server adapter.
orbixhlq.DEMO.CPP.BLD.JCLLIB (DATASV)	This JCL builds the C++ servers for the IMS two-phase commit client.
orbixhlq.DEMO.CPP.RUN.JCLLIB (DATAA)	This JCL runs the C++ server "A" for the IMS two-phase commit client.
orbixhlq.DEMO.CPP.RUN.JCLLIB (DATAB)	This JCL runs the C++ server "B" for the IMS two-phase commit client.
orbixhlq.DEMO.CPP.GEN	This PDS contains generated stub code for the C++ servers.
orbixhlq.DEMO.CPP.H	This PDS contains C++ header files.
orbixhlq.DEMO.CPP.HH	This PDS contains IDL generated header files.
orbixhlq.DEMO.CPP.LOADLIB	This PDS contains the C++ server module for the two-phase commit IMS client.
orbixhlq.DEMO.CPP.SRC	This PDS contains the C++ server module source code for the two-phase commit IMS client.
orbixhlq.DEMO.CPP.TWOPCA	This PDS contains the data store for the two-phase commit C++ server "A".
orbixhlq.DEMO.CPP.TWOPCB	This PDS contains the data store for the two-phase commit C++ server "B".

Supplied copybooks

Table 6 provides a summary in alphabetic order of the various copybooks supplied with your product installation that are relevant to IMS application development. Again, *orbixhlq* represents your installation's high-level qualifier.

Table 6: *Supplied Copybooks (Sheet 1 of 3)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(CERRSMFA)	This is relevant to IMS servers. It contains a COBOL paragraph that can be called by the IMS server, to check if a system exception has occurred and report it.
orbixhlq.INCLUDE.COPYLIB(CHKCLIMS)	This is relevant to IMS clients only. It contains a COBOL paragraph that can be called by the client, to check if a system exception has occurred and report it.
orbixhlq.INCLUDE.COPYLIB(CORBA)	This is relevant to both IMS clients and servers. It contains various Orbix COBOL definitions, such as `REQUEST-INFO` used by the `COAREQ` function, and `ORBIX-STATUS-INFORMATION` which is used to register and report system exceptions raised by the COBOL runtime.
orbixhlq.INCLUDE.COPYLIB(CORBATYP)	This is relevant to both IMS clients and servers. It contains the COBOL typecode representations for IDL basic types.
orbixhlq.INCLUDE.COPYLIB(GETUNIQE)	This is relevant to IMS clients only. It contains a COBOL paragraph that can be called by the client, to retrieve specific IMS segments. It does this by using the supplied IBM routine (interface) `CBLTDLI` to make an IMS DC (data communications) call that specifies the `GU` (get unique) function command.
orbixhlq.INCLUDE.COPYLIB(IMSWRITE)	This is relevant to IMS clients only. It contains a COBOL paragraph called `WRITE-DC-TEXT`, to write a segment to the IMS output message queue. It does this by using the supplied IBM routine (interface) `CBLTDLI` to make an IMS DC (data communications) call that specifies the `ISRT` (insert) function command.
orbixhlq.INCLUDE.COPYLIB(LSIMSPCB)	This is relevant to both IMS servers and clients. It is used in IMS server mainline and client programs. It contains the linkage section definitions of the program communication blocks (PCBs).

Table 6: *Supplied Copybooks (Sheet 2 of 3)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(UPDTPCBS)	This is relevant to IMS servers only. It is used in IMS server mainline and implementation programs. It contains a paragraph, used by the server mainline, that sets pointers to the PCB data defined in the linkage section (in the LSIMSPCB copybook). The pointers are defined in working storage (in the WSIMSPCB copybook). It also contains a paragraph, used by the server implementation, that uses the pointers (in the WSIMSPCB copybook) to map the PCB data defined in the linkage section (in the LSIMSPCB copybook).
orbixhlq.INCLUDE.COPYLIB(WSIMSCL)	This is relevant to both IMS servers and clients. It contains a COBOL data definition that defines the format of the message that can be written by the paragraph contained in *orbixhlq*.INCLUDE.COPYLIB(IMSWRITE). It also contains COBOL data definitions for calling the GU (get unique), CHNG (change), and ISRT (insert) commands.
orbixhlq.INCLUDE.COPYLIB(WSIMSPCB)	This is relevant to IMS servers only. It is used in IMS server mainline and implementation programs. It contains the working storage definitions of pointers to the PCB data. The IMS server mainline uses the UPDATE-WS-PCBS paragraph defined in the UPDTPCBS copybook, to populate the WSIMSPCB copybook with pointer values to the PCB data from the LSIMSPCB copybook. This allows the server implementation to access the PCB data, if required. The IMS server implementation uses the RETRIEVE-WS-PCBS paragraph defined in the UPDTPCBS copybook to retrieve the pointer values and map the data in the linkage section defined in the LSIMSPCB copybook. **Note:** This data is populated in the supplied demonstrations, but it is not used.
orbixhlq.INCLUDE.COPYLIB(WSURLSTR)	This is relevant to clients only. It contains a COBOL representation of the corbaloc URL IIOP string format. A client can call STRTOOBJ to convert the URL into an object reference. See "STRTOOBJ" on page 514 for more details.

Table 6: *Supplied Copybooks (Sheet 3 of 3)*

Location	Description
`orbixhlq.DEMO.IMS.CBL.COPYLIB`	This PDS is relevant to both IMS clients and servers. It is used to store all IMS copybooks generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. It also contains copybooks with Working Storage data definitions and Procedure Division paragraphs for use with the nested sequences demonstration.
`orbixhlq.DEMO.IMS.MFAMAP`	This PDS is relevant to IMS servers only. It is empty at installation time. It is used to store the IMS server adapter mapping member generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. The contents of the mapping member are the fully qualified interface name followed by the operation name followed by the IMS transaction name (for example, `(Simple/SimpleObject,call_me,SIMPLESV)`. See the *IMS Adapters Administrator's Guide* for more details about generating server adapter mapping members.
`orbixhlq.DEMO.TYPEINFO`	This PDS is relevant to IMS servers only. It is empty at installation time. It is used to store the type information that is generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. The contents of the type information member describe the contents of the given IDL file from which it was generated.

Checking JCL components

When creating the IMS simple client or server, or the IMS two-phase commit client, check that each step involved within the separate JCL components completes with a condition code of zero. If the condition codes are not zero, establish the point and cause of failure. The most likely cause is the site-specific JCL changes required for the compilers. Ensure that each high-level qualifier throughout the JCL reflects your installation.

Developing the Application Interfaces

Overview

This section describes the steps you must follow to develop the IDL interfaces for your application. It first describes how to define the IDL interfaces for the objects in your system. It then describes how to run the IDL compiler. Finally it provides an overview of the COBOL copybooks, server source code, and IMS server adapter mapping member that you can generate via the IDL compiler.

Steps to develop application interfaces

The steps to develop the interfaces to your application are:

Step	Action
1	Define public IDL interfaces to the objects required in your system. See "Defining IDL Interfaces" on page 60.
2	Use the `ORXCOPY` utility to copy your IDL files to z/OS (if necessary). See "ORXCOPY Utility" on page 553.
3	Run the Orbix IDL compiler to generate COBOL copybooks, server source, and server mapping member. See "Orbix IDL Compiler" on page 62.

Defining IDL Interfaces

Defining the IDL

The first step in writing any Orbix program is to define the IDL interfaces for the objects required in your system. The following is an example of the IDL for the `SimpleObject` interface that is supplied in *orbixhlq*.DEMO.IDL(SIMPLE):

```
// IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

Explanation of the IDL

The preceding IDL declares a `SimpleObject` interface that is scoped (that is, contained) within the `Simple` module. This interface exposes a single `call_me()` operation. This IDL definition provides a language-neutral interface to the CORBA `Simple::SimpleObject` type.

How the demonstration uses this IDL

For the purposes of the demonstrations in this chapter, the `SimpleObject` CORBA object is implemented in COBOL in the supplied `SIMPLES` server application. The server application creates a persistent server object of the `SimpleObject` type, and publishes its object reference to a PDS member. The client invokes the `call_me()` operation on the `SimpleObject` object, and then exits.

The batch demonstration client of the IMS demonstration server locates the `SimpleObject` object by reading the interoperable object reference (IOR) for the IMS server adapter from *orbixhlq*.DEMO.IORS(SIMPLE). In this case, the IMS server adapter IOR is published to *orbixhlq*.DEMO.IORS(SIMPLE) when you run *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIOR).

The IMS demonstration client of the batch demonstration server locates the `SimpleObject` object by reading the IOR for the batch server from *orbixhlq*.DEMO.IORS(SIMPLE). In this case, the batch server IOR is published to *orbixhlq*.DEMO.IORS(SIMPLE) when you run the batch server. The object reference for the server is represented to the demonstration IMS client as a corbaloc URL string in the form corbaloc:rir:/SimpleObject.

Orbix IDL Compiler

The Orbix IDL compiler

This subsection describes how to use the Orbix IDL compiler to generate COBOL copybooks, server source, and the IMS server adapter mapping member from IDL.

Note: If your IDL files are not already contained in z/OS data sets, you must copy them to z/OS before you proceed. You can use the `ORXCOPY` utility to do this. If necessary, see "ORXCOPY Utility" on page 553 for more details.

Note: Generation of COBOL copybooks is relevant to both IMS client and server development. Generation of server source and the IMS server adapter mapping member is relevant only to IMS server development.

Orbix IDL compiler configuration

The Orbix IDL compiler uses the Orbix configuration member for its settings. The `SIMPLIDL` JCL that runs the compiler uses the configuration member *orbixhlq*`.CONFIG(IDL)`. See "Orbix IDL Compiler" on page 315 for more details.

Example of the SIMPLIDL JCL

The following is the supplied JCL to run the Orbix IDL compiler for the IMS `SIMPLE` demonstration:

```
//SIMPLIDL JOB   (),
//          CLASS=A,
//          MSGCLASS=X,
//          MSGLEVEL=(1,1),
//          REGION=0M,
//          TIME=1440,
//          NOTIFY=&SYSUID,
//          COND=(4,LT)
//*-------------------------------------------------------------
//* Orbix - Generate the COBOL copybooks for the IMS Simple Demo
//*-------------------------------------------------------------
//          JCLLIB ORDER=(orbixhlq.PROCLIB)
//          INCLUDE MEMBER=(ORXVARS)
//*
//*
```

```
//IDLCBL   EXEC ORXIDL,
//         SOURCE=SIMPLE,
//         IDL=&ORBIX..DEMO.IDL,
//         COPYLIB=&ORBIX..DEMO.IMS.CBL.COPYLIB,
//         IMPL=&ORBIX..DEMO.IMS.CBL.SRC,
//         IDLPARM='-cobol:-S:-TIMS -mfa:-tSIMPLESV:-inf'
//*        IDLPARM='-cobol'
//IDLMFA   DD DISP=SHR,DSN=&ORBIX..DEMO.IMS.MFAMAP
//IDLTYPEI DD DISP=SHR,DSN=&ORBIX..DEMO.TYPEINFO
```

Explanation of the SIMPLIDL JCL

In the preceding JCL example, the lines `IDLPARM='-cobol'` and `IDLPARM='-cobol:-S:-TIMS -mfa:-tSIMPLESV:-inf'` are mutually exclusive. The line `IDLPARM='-cobol:-S:-TIMS -mfa:-tSIMPLESV:-inf'` is relevant to IMS server development and generates:

- COBOL copybooks via the `-cobol` argument.
- IMS server mainline code via the `-S:-TIMS` arguments.
- IMS server adapter mapping member via the `-mfa:-t`*`tran_name`* arguments.
- Type information for the `SIMPLE` IDL member via the `-inf` sub-argument to the `-mfa` argument.

Note: Because IMS server implementation code is already supplied for you, the `-Z` argument is not specified by default.

The line `IDLPARM='-cobol'` in the preceding JCL is relevant to IMS client development and generates only COBOL copybooks, because it only specifies the `-cobol` argument.

Note: The Orbix IDL compiler does not generate COBOL client source code.

Specifying what you want to generate

To indicate which of these lines you want the `SIMPLIDL` to recognize, comment out the line you do not want to use, by placing an asterisk at the start of that line. By default, as shown in the preceding example, the JCL is set to generate COBOL copybooks, server mainline code, an IMS server adapter mapping member, and type information for the `SIMPLE` IDL member. Alternatively, if you choose to comment out the line that has the

`-cobol:-S:-TIMS -mfa:-tSIMPLESV:-inf` arguments, the IDL compiler only generates COBOL copybooks.

See "Orbix IDL Compiler" on page 315 for more details of the Orbix IDL compiler and the JCL used to run it.

Running the Orbix IDL compiler

After you have edited the `SIMPLIDL` JCL according to your requirements, you can run the Orbix IDL compiler by submitting the following job:

```
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL)
```

Generated COBOL Copybooks, Source, and Mapping Member

Overview

This subsection describes all the COBOL copybooks, server source, and IMS server adapter mapping member that the Orbix IDL compiler can generate from IDL definitions.

Note: The generated COBOL copybooks are relevant to both IMS client and server development. The generated source and adapter mapping member are relevant only to IMS server development. The IDL compiler does not generate COBOL client source.

Member name restrictions

Generated copybook, source code, and mapping member names are all based on the IDL member name. If the IDL member name exceeds six characters, the Orbix IDL compiler uses only the first six characters of the IDL member name when generating the other member names. This allows space for appending the two-character `SV` suffix to the name for the server mainline member, while allowing it to adhere to the eight-character maximum size limit for z/OS member names. Consequently, all other member names also use only the first six characters of the IDL member name, followed by their individual suffixes, as appropriate.

How IDL maps to COBOL copybooks

Each IDL interface maps to a group of COBOL data definitions. There is one definition for each IDL operation. A definition contains each of the parameters for the relevant IDL operation in their corresponding COBOL representation. See "IDL-to-COBOL Mapping" on page 237 for details of how IDL types map to COBOL.

Attributes map to two operations (`get` and `set`), and readonly attributes map to a single `get` operation.

Generated COBOL copybooks

Table 7 shows the COBOL copybooks that the Orbix IDL compiler generates, based on the defined IDL.

Table 7: *Generated COBOL Copybooks*

Copybook	JCL Keyword Parameter	Description
idlmembername	COPYLIB	This copybook contains data definitions that are used for working with operation parameters and return values for each interface defined in the IDL member. The name for this copybook does not take a suffix.
*idlmembername*X	COPYLIB	This copybook contains data definitions that are used by the COBOL runtime to support the interfaces defined in the IDL member. This copybook is automatically included in the *idlmembername* copybook.
*idlmembername*D	COPYLIB	This copybook contains procedural code for performing the correct paragraph for the requested operation. This copybook is automatically included in the *idlmembername*S source code member.

Generated server source members

Table 8 shows the server source code members that the Orbix IDL compiler generates, based on the defined IDL.

Table 8: *Generated Server Source Code Members*

Member	JCL Keyword Parameter	Description
*idlmembername*S	IMPL	This is the IMS server implementation source code member. It contains stub paragraphs for all the callable operations. This is only generated if you specify both the -Z and -TIMS arguments with the IDL compiler.
*idlmembername*SV	IMPL	This is the IMS server mainline source code member. This is only generated if you specify both the -S and -TIMS arguments with the IDL compiler.

Note: For the purposes of this example, the SIMPLES server implementation is already provided in your product installation. Therefore, the -Z IDL compiler argument used to generate it is not specified in the supplied SIMPLIDL JCL. The SIMPLESV server mainline is not already provided, so the -S:-TIMS arguments used to generate it are specified in the supplied JCL. See "Orbix IDL Compiler" on page 315 for more details of the -S, -Z, and -TIMS arguments to generate IMS server code.

Generated server adapter mapping member

Table 9 shows the IMS server adapter mapping member that the Orbix IDL compiler generates, based on the defined IDL.

Table 9: *Generated IMS Server Adapter Mapping Member*

Copybook	JCL Keyword Parameter	Description
*idlmembername*A	IDLMFA	This is a simple text file that determines what interfaces and operations the IMS server adapter supports, and the IMS transaction names to which the IMS server adapter should map each IDL operation.

Generated type information member

shows the IMS server adapter mapping member that the Orbix IDL compiler generates, based on the defined IDL.

Table 10: *Generated Type Information Member*

Copybook	JCL Keyword Parameter	Description
*idlmembername*B	IDLTYPEI	Type information describing the operation signatures of the interface whose IDL it was generated from.

Location of demonstration copybooks and mapping member

You can find examples of the copybooks, server source, and IMS server adapter mapping member generated for the `SIMPLE` demonstration in the following locations:

- *orbixhlq*.DEMO.IMS.CBL.COPYLIB(SIMPLE)
- *orbixhlq*.DEMO.IMS.CBL.COPYLIB(SIMPLEX)
- *orbixhlq*.DEMO.IMS.CBL.COPYLIB(SIMPLED)
- *orbixhlq*.DEMO.IMS.CBL.SRC(SIMPLESV)
- *orbixhlq*.DEMO.IMS.CBL.SRC(SIMPLES)
- *orbixhlq*.DEMO.IMS.MFAMAP(SIMPLEA)
- *orbixhlq*.DEMO.TYPEINFO(SIMPLEB)

Note: Except for the `SIMPLES` member, none of the preceding elements are shipped with your product installation. They are generated when you run *`orbixhlq`*`.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL)`, to run the Orbix IDL compiler.

Developing the IMS Server

Overview

This section describes the steps you must follow to develop the IMS server executable for your application. The IMS server developed in this example will be contacted by the simple batch client demonstration.

Steps to develop the server

The steps to develop the server application are:

Step	Action
1	“Writing the Server Implementation” on page 71.
2	“Writing the Server Mainline” on page 76.
3	“Building the Server” on page 80.
4	“Preparing the Server to Run in IMS” on page 81.

Writing the Server Implementation

The server implementation module

You must implement the server interface by writing a COBOL module that implements each operation in the *idlmembername* copybook. For the purposes of this example, you must write a COBOL module that implements each operation in the `SIMPLE` copybook. When you specify the `-Z` and `-TIMS` arguments with the Orbix IDL compiler, it generates a skeleton server implementation module, in this case called `SIMPLES`, which is a useful starting point.

Note: For the purposes of this demonstration, the IMS server implementation module, `SIMPLES`, is already provided for you, so the `-Z` argument is not specified in the JCL that runs the IDL compiler.

Example of the IMS SIMPLES module

The following is an example of the IMS `SIMPLES` module:

Example 4: *The IMS SIMPLES Demonstration (Sheet 1 of 3)*

```
****************************************************************
* Identification Division
****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID.             SIMPLES.

ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.

01 WS-INTERFACE-NAME                     PICTURE X(30).
01 WS-INTERFACE-NAME-LENGTH              PICTURE 9(09) BINARY
                                         VALUE 30.

COPY SIMPLE.
COPY CORBA.
1 COPY WSIMSPCB.
2 COPY WSIMSCL.
3 COPY LSIMSPCB.
```

Example 4: *The IMS SIMPLES Demonstration (Sheet 2 of 3)*

```
****************************************************************
* Procedure Division
****************************************************************
PROCEDURE DIVISION.

4       ENTRY "DISPATCH".

5       PERFORM RETRIEVE-WS-PCBS.

6       CALL "COAREQ"    USING REQUEST-INFO.
        SET WS-COAREQ TO TRUE.
        PERFORM CHECK-STATUS.

7   * Resolve the pointer reference to the interface name which is
    * the fully scoped interface name
    * Note make sure it can handle the max interface name length
        CALL "STRGET"    USING INTERFACE-NAME
                               WS-INTERFACE-NAME-LENGTH
                               WS-INTERFACE-NAME.
        SET WS-STRGET TO TRUE.
        PERFORM CHECK-STATUS.

****************************************************************
* Interface(s)  evaluation:
****************************************************************
        MOVE SPACES TO SIMPLE-SIMPLEOBJECT-OPERATION.

        EVALUATE WS-INTERFACE-NAME
        WHEN 'IDL:Simple/SimpleObject:1.0'

8   * Resolve the pointer reference to the operation information
        CALL "STRGET" USING OPERATION-NAME
                            SIMPLE-S-4B4B-OPERATION-LENGTH
                            SIMPLE-SIMPLEOBJECT-OPERATION
        SET WS-STRGET TO TRUE
        PERFORM CHECK-STATUS
        DISPLAY  "Simple::" SIMPLE-SIMPLEOBJECT-OPERATION
                   "invoked"
        END-EVALUATE.

9   COPY SIMPLED.

        GOBACK.
```

Example 4: *The IMS SIMPLES Demonstration (Sheet 3 of 3)*

```
10  DO-SIMPLE-SIMPLEOBJECT-CALL-ME.
        CALL "COAGET"    USING SIMPLE-SIMPLEOBJECT-DCD9-ARGS.
        SET WS-COAGET TO TRUE.
        PERFORM CHECK-STATUS.

11  *****************************************************************
    *
    *  An example of using a PCB in the server implementation.
    *
    *  'CHNG' is defined in copybook WSIMSCL.
    *  'LS-ALT-PCB' is defined in copybook LSIMSPCB.
    *  'NEW-DEST' is user defined in working storage:
    *  77  NEW-DEST   PIC X(8) VALUE 'MYDEST'.
    *
    *  CALL 'CBLTDLI' USING CHNG
    *                       LS-ALT-PCB
    *                       NEW-DEST
    *  END-CALL.
    *
    *  DISPLAY 'CHNG STATUS CODE:  '''
    *           LS-ALTPCB-STATUS-CODE
    *           ''' '
    *           LS-ALTPCB-DEST-NAME.
    *
    *****************************************************************

        CALL "COAPUT"    USING SIMPLE-SIMPLEOBJECT-DCD9-ARGS.
        SET WS-COAPUT TO TRUE.
        PERFORM CHECK-STATUS.

    *****************************************************************
    * Retrieve the working storage PCB definitions
    *****************************************************************
12  COPY UPDTPCBS

    *****************************************************************
    * Check Errors Copybook
    *****************************************************************
13  COPY CERRSMFA.
```

Explanation of the IMS SIMPLES module

The IMS `SIMPLES` module can be explained as follows:

1. The `COPY WSIMSPCB` statement provides access to IMS PCBs.
2. The `COPY WSIMSCL` statement provides definitions that can be used when making calls, such as `CHNG` or `ISRT`, to `CBLTDLI`.
3. The `COPY LSIMSPCB` statement provides definitions for the IMS PCBs that are mapped by the pointers defined in the `WSIMSPCB` copybook.
4. The `DISPATCH` logic is automatically coded for you, and the bulk of the code is contained in the `SIMPLED` copybook. When an incoming request arrives from the network, it is processed by the ORB and a call is made to the `DISPATCH` entry point.
5. The `RETRIEVE-WS-PCBS` paragraph maps the IMS PCB data defined in the linkage section (in the `LSIMSPCB` copybook) with the pointers defined in Working Storage (in the `WSIMSPCB` copybook).
6. `COAREQ` is called to provide information about the current invocation request, which is held in the `REQUEST-INFO` block that is contained in the `CORBA` copybook.

   `COAREQ` is called once for each operation invocation—after a request has been dispatched to the server, but before any calls are made to access the parameter values.
7. `STRGET` is called to copy the characters in the unbounded string pointer for the interface name to the string item representing the fully scoped interface name.
8. `STRGET` is called again to copy the characters in the unbounded string pointer for the operation name to the string item representing the operation name.
9. The procedural code used to perform the correct paragraph for the requested operation is copied into the module from the `SIMPLED` copybook.
10. Each operation has skeleton code, with appropriate calls to `COAPUT` and `COAGET` to copy values to and from the COBOL structures for that operation’s argument list. You must provide a correct implementation for each operation. You must call `COAGET` and `COAPUT`, even if your operation takes no parameters and returns no data. You can simply pass in a dummy area as the parameter list.

11. Some comments that illustrate how to make an IMS change call, using the alternate PCB.
12. The `COPY UPDTPCBS` statement defines the `RETRIEVE-WS-PCBS` paragraph.
13. The IMS server implementation uses a `COPY CERRSMFA` statement instead of `COPY CHKERRS`.

Note: The supplied `SIMPLES` module is only a suggested way of implementing an interface. It is not necessary to have all operations implemented in the same COBOL module.

Location of the IMS SIMPLES module

You can find a complete version of the IMS `SIMPLES` server implementation module in *`orbixhlq`*`.DEMO.IMS.CBL.SRC(SIMPLES)`.

Writing the Server Mainline

The server mainline module

The next step is to write the server mainline module in which to run the server implementation. For the purposes of this example, when you specify the `-S` and `-TIMS` arguments with the Orbix IDL compiler, it generates a module called `SIMPLESV`, which contains the server mainline code.

Note: Unlike the batch server mainline, the IMS server mainline does not have to create and store stringified object references (IORs) for the interfaces that it implements, because this is handled by the IMS server adapter.

Example of the IMS SIMPLESV module

The following is an example of the IMS `SIMPLESV` module:

Example 5: *The IMS SIMPLESV Demonstration (Sheet 1 of 3)*

```
IDENTIFICATION DIVISION.
PROGRAM-ID.            SIMPLESV.
ENVIRONMENT DIVISION.
DATA DIVISION.

WORKING-STORAGE SECTION.

COPY SIMPLE.
COPY CORBA.
COPY WSIMSPCB.

01 ARG-LIST                             PICTURE X(01)
                                        VALUE SPACES.
01 ARG-LIST-LEN                         PICTURE 9(09) BINARY
                                        VALUE 0.
01 ORB-NAME                             PICTURE X(10)
                                        VALUE "simple_orb".
01 ORB-NAME-LEN                         PICTURE 9(09) BINARY
                                        VALUE 10.
01 SERVER-NAME                          PICTURE X(07)
                                        VALUE "simple ".
01 SERVER-NAME-LEN                      PICTURE 9(09) BINARY
                                        VALUE 6.
```

Example 5: *The IMS SIMPLESV Demonstration (Sheet 2 of 3)*

```
 01 INTERFACE-LIST.
    03 FILLER                              PICTURE X(28)
        VALUE "IDL:Simple/SimpleObject:1.0 ".
 01 INTERFACE-NAMES-ARRAY REDEFINES INTERFACE-LIST.
    03 INTERFACE-NAME OCCURS 1 TIMES       PICTURE X(28).

 01 OBJECT-ID-LIST.
    03 FILLER                              PICTURE X(27)
        VALUE "Simple/SimpleObject_object ".
 01 OBJECT-ID-ARRAY REDEFINES OBJECT-ID-LIST.
    03 OBJECT-IDENTIFIER OCCURS 1 TIMES    PICTURE X(27).

****************************************************************
* Object values for the Interface(s)
****************************************************************
 01 SIMPLE-SIMPLEOBJECT-OBJ               POINTER
                                          VALUE NULL.

 COPY LSIMSPCB.

 PROCEDURE DIVISION USING LS-IO-PCB, LS-ALT-PCB.

 INIT.
     PERFORM UPDATE-WS-PCBS.

1    CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.
     SET WS-ORBSTAT TO TRUE.
     PERFORM CHECK-STATUS.

2    CALL "ORBARGS"   USING ARG-LIST
                            ARG-LIST-LEN
                            ORB-NAME
                            ORB-NAME-LEN.
     SET WS-ORBARGS TO TRUE.
     PERFORM CHECK-STATUS.

3    CALL "ORBSRVR"   USING SERVER-NAME
                            SERVER-NAME-LEN.
     SET WS-ORBSRVR TO TRUE.
     PERFORM CHECK-STATUS.

****************************************************************
* Interface Section Block
****************************************************************
```

Example 5: *The IMS SIMPLESV Demonstration (Sheet 3 of 3)*

```
*  Generating Object Reference for interface Simple/SimpleObject

4       CALL "ORBREG"  USING SIMPLE-SIMPLEOBJECT-INTERFACE.
        SET WS-ORBREG TO TRUE.
        PERFORM CHECK-STATUS.

5       CALL "OBJNEW"  USING SERVER-NAME
                             INTERFACE-NAME OF INTERFACE-NAMES-ARRAY(1)
                               OBJECT-IDENTIFIER OF OBJECT-ID-ARRAY(1)
                               SIMPLE-SIMPLEOBJECT-OBJ.
        SET WS-OBJNEW TO TRUE.
        PERFORM CHECK-STATUS.

6       CALL "COARUN".
        SET WS-COARUN TO TRUE.
        PERFORM CHECK-STATUS.

7       CALL "OBJREL" USING SIMPLE-SIMPLEOBECT-OBJ.
        SET WS-OBJREL TO TRUE.
        PERFORM CHECK-STATUS.

EXIT-PRG.
    GOBACK.

****************************************************************
* Populate the working storage PCB definitions
****************************************************************
COPY UPDTPCBS.


****************************************************************
* Check Errors Copybook
****************************************************************
COPY CERRSMFA.
```

Explanation of the IMS SIMPLESV module

The IMS SIMPLESV module can be explained as follows:

1. ORBSTAT is called to register the ORBIX-STATUS-INFORMATION block that is contained in the CORBA copybook. Registering the ORBIX-STATUS-INFORMATION block allows the COBOL runtime to populate it with exception information, if necessary.
2. ORBARGS is called to initialize a connection to the ORB.

3. `ORBSRVR` is called to set the server name.
4. `ORBREG` is called to register the IDL interface, `SimpleObject`, with the Orbix COBOL runtime.
5. `OBJNEW` is called to create a persistent server object of the `SimpleObject` type, with an object ID of `my_simple_object`.
6. `COARUN` is called, to enter the `ORB::run` loop, to allow the ORB to receive and process client requests. This then processes the CORBA request that the IMS server adapter sends to IMS. If the transaction has been defined as WFI, multiple requests can be processed in the `COARUN` loop; otherwise, `COARUN` processes only one request.
7. `OBJREL` is called to ensure that the servant object is released properly.

Location of the IMS SIMPLESV module

You can find a complete version of the IMS `SIMPLESV` server mainline module in *orbixhlq*.`DEMO.IMS.CBL.SRC(SIMPLESV)` after you have run *orbixhlq*.`DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL)` to run the Orbix IDL compiler.

Building the Server

Location of the JCL

Sample JCL used to compile and link the IMS server mainline and server implementation is in *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLESB).

When using a COBOL compiler later than 4.2, use this sample JCL:

orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB(SIMPBDSB)

Resulting load module

When this JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.IMS.CBL.LOADLIB(SIMPLESV).

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

orbixhlq.DEMO.IMS.CBL.BD.LOADLIB(SIMPLESV)

Preparing the Server to Run in IMS

Overview

This section describes the required steps to allow the server to run in an IMS region. These steps assume you want to run the IMS server against a batch client. When all the steps in this section have been completed, the server is started automatically within IMS, as required.

Steps

The steps to enable the server to run in an IMS region are:

Step	Action
1	Define a transaction definition for IMS.
2	Provide the IMS server load module to an IMS region.
3	Generate mapping member entries for the IMS server adapter.
4	Add the interface's operation signatures to the type information repository, stored in the `TYPEINFO` PDS.
5	Obtain the IOR for use by the client program.

Step 1—Defining transaction definition for IMS

A transaction definition must be created for the server, to allow it to run in IMS. The following is the transaction definition for the supplied demonstration:

```
    APPLCTN    GPSB=SIMPLESV,                                              x
          PGMTYPE=(TP,,2),                                                 x
          SCHDTYP=PARALLEL
    TRANSACT   CODE=SIMPLESV,                                              x
          EDIT=(ULC)
```

Step 2—Providing load module to IMS region

Ensure that the *orbixhlq*.DEMO.IMS.CBL.LOADLIB PDS is added to the STEPLIB for the IMS region that is to run the transaction, or copy the `SIMPLESV` load module to a PDS in the STEPLIB of the relevant IMS region.

When using a COBOL compiler later than version 4.2, use this PDSE:

orbixhlq.DEMO.IMS.CBL.BD.LOADLIB

Step 3—Generating mapping member entries

The IMS server adapter requires mapping member entries, so that it knows which IMS transaction should be run for a particular interface and operation. The mapping member entry for the supplied example is contained in `orbixhlq.DEMO.IMS.MFAMAP(SIMPLEA)` (after you run the IDL compiler) and appears as follows:

```
(Simple/SimpleObject,call_me,SIMPLESV)
```

The generation of a mapping member for the IMS server adapter is performed by the `orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL)` JCL. The `-mfa:-ttran_name` argument with the IDL compiler generates the mapping member. For the purposes of this example, *tran_name* is replaced with `SIMPLESV`. An `IDLMFA` DD statement must also be provided in the JCL, to specify the PDS into which the mapping member is generated. See the *IMS Adapters Administrator's Guide* for full details about IMS server adapter mapping members.

Step 4—Adding operation signatures to type_info store

The IMS server adapter needs to be able to obtain operation signatures for the COBOL server. For the purposes of this demonstration, the `TYPEINFO` PDS is used to store this type information. This type information is necessary so that the adapter knows what data types it has to marshal into IMS for the server, and what data types it can expect back from the IMS transaction. This information is generated by supplying the `-mfa:-inf` option to the Orbix IDL compiler, for example, as used in the `SIMPLIDL` JCL that is used to generate the source code and copybooks for this demonstration.

Note: An IDL interface only needs to be added to the type information store once.

Note: An alternative to using type information files is to use the Interface Repository (IFR). This is an alternative method of allowing the IMS server adapter to retrieve IDL type information. If you are using the IFR, you must ensure that the relevant IDL for the server has been added to the IFR (that is, registered with it) before the IMS server adapter is started.

To add IDL to the IFR, first ensure the IFR is running. You can use the JCL in `orbixhlq.JCLLIB(IFR)` to start it. Then, in the JCL that you use to run the Orbix IDL compiler, add the line `// IDLPARM='-R'` to register the IDL. In this case, ensure that all other `// IDLPARM` lines are commented out as follows: `//* IDLPARM...`

Step 5—Obtaining the server adapter IOR

The final step is to obtain the IOR that the batch client needs to locate the IMS server adapter. Before you do this, ensure all of the following:

- The type_info store contains the relevant operation signatures (or, if using the IFR, the IFR is running and contains the relevant IDL). See "Step 4—Adding operation signatures to type_info store" on page 82 for details of how to populate the type_info store.
- The IMS server adapter mapping member contains the relevant mapping entries. For the purposes of this example, ensure that the `orbixhlq.DEMO.IMS.MFAMAP(SIMPLEA)` mapping member is being used. See the *IMS Adapters Administrator's Guide* for details about IMS server adapter mapping members.
- The IMS server adapter is running. The supplied JCL in `orbixhlq.JCLLIB(IMSA)` starts the IMS server adapter. See the *IMS Adapters Administrator's Guide* for more details.

Now submit *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIOR), to obtain the IOR that the batch client needs to locate the IMS server adapter. This JCL includes the `resolve` command, to obtain the IOR. The following is an example of the `SIMPLIOR` JCL:

```
//         JCLLIB ORDER=(orbixhlq.PROCLIB)
//         INCLUDE MEMBER=(ORXVARS)
//*
//* Request the IOR for the IMS 'simple_persistent' server
//* and store it in a PDS for use by the client.
//*
//* Make the following changes before running this JCL:
//*
//* 1.  Change 'SET DOMAIN='DEFAULT@' to you configuration
//*     domain name.
//*
//           SET DOMAIN='DEFAULT@'
//*
//REG     EXEC PROC=ORXADMIN,
//  PPARM='mfa resolve Simple/SimpleObject > DD:IOR'
//IOR  DD DSN=&ORBIX..DEMO.IORS(SIMPLE),DISP=SHR
//ORBARGS   DD *
-ORBname iona_utilities.imsa
/*
//ITDOMAIN DD DSN=&ORBIXCFG(&DOMAIN),DISP=SHR
```

When you submit the `SIMPLIOR` JCL, it writes the IOR for the IMS server adapter to *orbixhlq*.DEMO.IORS(SIMPLE).

Developing the IMS Client

Overview

This section describes the steps you must follow to develop the IMS client executable for your application. The IMS client developed in this example will connect to the simple batch server demonstration.

Note: The Orbix IDL compiler does not generate COBOL client stub code.

Steps to develop the client

The steps to develop and run the client application are:

Step	Action
1	"Writing the Client" on page 86.
2	"Building the Client" on page 92.
3	"Preparing the Client to Run in IMS" on page 93.

Writing the Client

The client program

The next step is to write the client program, to implement the IMS client. This example uses the supplied `SIMPLECL` client demonstration.

Example of the SIMPLECL module

The following is an example of the IMS `SIMPLECL` module:

Example 6: *The IMS SIMPLECL Demonstration (Sheet 1 of 4)*

```
***************************************************************
*
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*
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* Micro Focus and its affiliates and licensors
* ("Micro Focus") are as may be set forth in the express
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* provided to the U.S. Government, consistent with FAR
* 12.211 and 12.212, Commercial Computer Software, Computer
* Software Documentation, and Technical Data for Commercial
* Items are licensed to the U.S. Government under vendor's
* standard commercial license.
*
****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.                    SIMPLECL.

 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 INPUT-OUTPUT SECTION.
 DATA DIVISION.

 WORKING-STORAGE SECTION.
```

Example 6: *The IMS SIMPLECL Demonstration (Sheet 2 of 4)*

```
 COPY SIMPLE.
 COPY CORBA.
 COPY WSIMSCL.

1 01 WS-SIMPLE-URL                    PICTURE X(27) VALUE
     "corbaloc:rir:/SimpleObject ".
 01 WS-SIMPLE-URL-LENGTH             PICTURE 9(9) BINARY
                                     VALUE 27.
 01 WS-SIMPLE-URL-PTR                POINTER
                                     VALUE NULL.
 01 SIMPLE-SIMPLEOBJECT-OBJ          POINTER
                                     VALUE NULL.
 01 ARG-LIST                         PICTURE X(80)
                                     VALUE SPACES.
 01 ARG-LIST-LEN                     PICTURE 9(09) BINARY
                                     VALUE 0.
 01 ORB-NAME                         PICTURE X(10)
                                     VALUE "simple_orb".
 01 ORB-NAME-LEN                     PICTURE 9(09) BINARY
                                       VALUE 10.
 COPY LSIMSPCB.
 PROCEDURE DIVISION USING LS-IO-PCB, LS-ALT-PCB.
 0000-MAINLINE.
 COPY GETUNIQE.
2     CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.

*  ORB initialization
      DISPLAY "Initializing the ORB".
3     CALL "ORBARGS"   USING ARG-LIST
                             ARG-LIST-LEN
                             ORB-NAME
                             ORB-NAME-LEN.
      SET WS-ORBARGS TO TRUE.
      PERFORM CHECK-STATUS.

* Register interface SimpleObject
      DISPLAY "Registering the Interface".
4     CALL  "ORBREG"   USING SIMPLE-SIMPLEOBJECT-INTERFACE.
      SET WS-ORBREG TO TRUE.
      PERFORM CHECK-STATUS.

* Set the COBOL pointer to point to the URL string
5     CALL "STRSET"    USING WS-SIMPLE-URL-PTR
                             WS-SIMPLE-URL-LENGTH
                             WS-SIMPLE-URL.
```

Example 6: *The IMS SIMPLECL Demonstration (Sheet 3 of 4)*

```
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.
* Obtain object reference from the url
6    CALL "STRTOOBJ"  USING WS-SIMPLE-URL-PTR
                           SIMPLE-SIMPLEOBJECT-OBJ.

     SET WS-STRTOOBJ TO TRUE.
     PERFORM CHECK-STATUS.
* Releasing the memory
     CALL "STRFREE"   USING WS-SIMPLE-URL-PTR.
     SET WS-STRFREE TO TRUE.
     PERFORM CHECK-STATUS.

     SET SIMPLE-SIMPLEOBJECT-CALL-ME    TO TRUE
     DISPLAY "invoking Simple::" SIMPLE-SIMPLEOBJECT-OPERATION.

7    CALL "ORBEXEC"   USING SIMPLE-SIMPLEOBJECT-OBJ
                           SIMPLE-SIMPLEOBJECT-OPERATION
                           SIMPLE-SIMPLEOBJECT-DCD9-ARGS
                           SIMPLE-USER-EXCEPTIONS.
     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS

8    CALL "OBJREL" USING SIMPLE-SIMPLEOBJECT-OBJ.
     SET WS-OBJREL TO TRUE.
     PERFORM CHECK-STATUS.

     DISPLAY "Simple demo complete.".
     MOVE 38     TO OUT-LL  OF
                    OUTPUT-AREA.
     MOVE "Simple Transaction completed" TO
          OUTPUT-LINE OF OUTPUT-AREA.
9    PERFORM WRITE-DC-TEXT THRU WRITE-DC-TEXT-END.

 EXIT-PRG.
*========.
     GOBACK.

****************************************************************
* Output IMS segment.
****************************************************************
10 COPY IMSWRITE.
****************************************************************
* Check Errors Copybook
****************************************************************
```

Example 6: *The IMS SIMPLECL Demonstration (Sheet 4 of 4)*

11
```
COPY CHKCLIMS.
```

Explanation of the SIMPLECL module

The IMS `SIMPLECL` module can be explained as follows:

1. `WS-SIMPLE-URL` defines a corbaloc URL string in the `corbaloc:rir` format. This string identifies the server with which the client is to communicate. This string can be passed as a parameter to `STRTOOBJ`, to allow the client to retrieve an object reference to the server. See point **6** about `STRTOOBJ` for more details.
2. `ORBSTAT` is called to register the `ORBIX-STATUS-INFORMATION` block that is contained in the `CORBA` copybook. Registering the `ORBIX-STATUS-INFORMATION` block allows the COBOL runtime to populate it with exception information, if necessary.

   You can use the `ORBIX-STATUS-INFORMATION` data item (in the `CORBA` copybook) to check the status of any Orbix call. The `EXCEPTION-NUMBER` numeric data item is important in this case. If this item is `0`, it means the call was successful. Otherwise, `EXCEPTION-NUMBER` holds the system exception number that occurred. You should test this data item after any Orbix call.
3. `ORBARGS` is called to initialize a connection to the ORB.
4. `ORBREG` is called to register the IDL interface with the Orbix COBOL runtime.
5. `STRSET` is called to create an unbounded string to which the stringified object reference is copied.
6. `STRTOOBJ` is called to create an object reference to the server object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string in the form `corbaloc:rir:/SimpleObject` (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.
7. After the object reference is created, `ORBEXEC` is called to invoke operations on the server object represented by that object reference. You must pass the object reference, the operation name, the argument description packet, and the user exception buffer. The operation name

must be terminated with a space. The same argument description is used by the server. For ease of use, string identifiers for operations are defined in the `SIMPLE` copybook. For example, see *orbixhlq*.DEMO.IMS.CBL.COPYLIB(SIMPLE).

8. `OBJREL` is called to ensure that the servant object is released properly.
9. The `WRITE-DC-TEXT` paragraph is copied in from the `IMSWRITE` copybook and is used to write messages to the IMS output message queue. The client uses this to indicate whether the call was successful or not.

10. A paragraph that writes messages generated by the demonstrations to the IMS message queue is copied in from the `IMSWRITE` copybook.
11. The error-checking routine for system exceptions generated by the demonstrations is copied in from the `CHKCLIMS` copybook.

Location of the SIMPLECL module

You can find a complete version of the IMS `SIMPLECL` client module in *`orbixhlq`*`.DEMO.IMS.CBL.SRC(SIMPLECL)`.

Building the Client

JCL to build the client

Sample JCL used to compile and link the client can be found in the third step of *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLECB).

When using a COBOL compiler later than 4.2, use this sample JCL:

orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB(SIMPBDCB)

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.IMS.CBL.LOADLIB(SIMPLECL).

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

orbixhlq.DEMO.IMS.CBL.BD.LOADLIB(SIMPLECL)

Preparing the Client to Run in IMS

Overview

This section describes the required steps to allow the client to run in an IMS region. These steps assume you want to run the IMS client against a batch server.

Steps

The steps to enable the client to run in an IMS region are:

Step	Action
1	Define an APPC transaction definition for IMS.
2	Provide the IMS client load module to the IMS region.
3	Start the locator and node daemon on the server host.
4	Add the interface's operation signatures to the type information repository.
5	Start the batch server.
6	Customize the batch server IOR.
7	Configure and run the client adapter.

Step 1—Define transaction definition for IMS

A transaction definition must be created for the client, to allow it to run in IMS. The following is the transaction definition for the supplied demonstration:

```
     APPLCTN    GPSB=SIMPLECL,                                            x
           PGMTYPE=(TP,,2),                                               x
           SCHDTYP=PARALLEL
     TRANSACT   CODE=SIMPLECL,                                            x
           EDIT=(ULC)
```

Step 2—Provide client load module to IMS region

Ensure that the *orbixhlq*.DEMO.IMS.CBL.LOADLIB PDS is added to the STEPLIB for the IMS region that is to run the transaction.

Note: If you have already done this for your IMS server load module, you do not need to do this again.

Alternatively, you can copy the SIMPLECL load module to a PDS in the STEPLIB of the relevant IMS region.

When using a COBOL compiler later than version 4.2, use this PDSE:

orbixhlq.DEMO.IMS.CBL.BD.LOADLIB

Step 3—Start locator and node daemon on server host

This step assumes that you intend running the IMS client against the supplied batch demonstration server.

In this case, you must start all of the following on the batch server host (if they have not already been started):

1. Start the locator daemon by submitting *orbixhlq*.JCLLIB(LOCATOR).
2. Start the node daemon by submitting *orbixhlq*.JCLLIB(NODEDAEM).

See "Running the Server and Client" on page 45 for more details of running the locator and node daemon on the batch server host.

Step 4—Add operation signatures to type_info store

The client adapter needs to be able to know what data types it can expect to marshal from the IMS transaction, and what data types it should expect back from the batch server. This can be done by creating a type information file by running the Orbix IDL compiler with the -mfa:-inf flag, which is included in *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(SIMPLIDL). The type information file contains descriptions of the interface's operation signatures (that is, information about the type and direction of the operation parameters, the number of parameters, and whether or not an operation has a return type).

Before the client adapter is run, the TYPEINFO DD card needs to be updated to the location of the TYPEINFO PDS (for the purposes of this example, to *orbixhlq*.DEMO.TYPEINFO).

Note: An IDL interface only needs to be added to the type information store once.

Note: An alternative to using type information files is to use the Interface Repository (IFR). This is an alternative method of allowing the client adapter to obtain information about relevant data types. If you are using the IFR, you must ensure that the relevant IDL for the server has been added to the IFR (that is, registered with it) before the client adapter is started.

To add IDL to the IFR, first ensure the IFR is running. You can use the JCL in `orbixhlq.JCLLIB(IFR)` to start it. Then, in the JCL that you use to run the Orbix IDL compiler, add the line `// IDLPARM='-R'` to register the IDL. In this case, ensure that all other `// IDLPARM` lines are commented out as follows: `//*  IDLPARM…`

Step 5—Start batch server

This step assumes that you intend running the IMS client against the demonstration batch server.

Submit the following JCL to start the batch server:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPLESV)
```

See “Running the Server and Client” on page 45 for more details of running the locator and node daemon on the batch server host.

When using a COBOL compiler later than version 4.2, use this JCL:

`orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPBDSV)`

Step 6—Customize batch server IOR

When you run the demonstration batch server it publishes its IOR to a member called `orbixhlq.DEMO.IORS(SIMPLE)`. The demonstration IMS client needs to use this IOR to contact the demonstration batch server.

The demonstration IMS client obtains the object reference for the demonstration batch server in the form of a corbaloc URL string. A corbaloc URL string can take different formats. For the purposes of this demonstration, it takes the form `corbaloc:rir:/SimpleObject`. This form of the corbaloc URL string requires the use of a configuration variable, `initial_references:SimpleObject:reference`, in the configuration domain. When you submit the JCL in `orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB(UPDTCONF)`, it automatically adds this configuration entry to the configuration domain:

```
initial_references:SimpleObject:reference = "IOR…";
```

The IOR value is taken from the `*orbixhlq*.DEMO.IORS(SIMPLE)` member.

See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

Step 7—Configure and run client adapter

The client adapter must now be configured before you can start the client (the IMS transaction). See the *IMS Adapters Administrator's Guide* for details of how to configure the client adapter.

When you have configured the client adapter, you can run it by submitting `*orbixhlq*.JCLLIB(IMSCA)`.

> **Note:** See "Running the Demonstrations" on page 119 for details of how to run the sample demonstration.

Developing the IMS Two-Phase Commit Client

Overview

This section describes the steps you must follow to develop the IMS two-phase commit client executable for your application. The IMS two-phase commit client developed in this example will connect to two demonstration C++ batch servers.

Note: The APPC transport must be configured for two-phase commit support. The cross memory communication transport does not support two-phase commit.

Steps to develop the client

The steps to develop and run the client application are:

Step	Action
1	"Writing the Client" on page 98.
2	"Building the Client" on page 114.
3	"Building the Servers" on page 115.
4	"Preparing the Client to Run in IMS" on page 116.

Writing the Client

The client program

The next step is to write the IMS client transaction. This example uses the supplied `DATACL` client demonstration.

IMS transaction design

An IMS transaction that uses two-phase commit can be broken down as follows:

- Operations that do not require two-phase commit.
- Operations that require two-phase commit.

Read-only operations to local databases or remote servers do not require two-phase commit processing. These operations should be performed first in the IMS transaction ahead of the two-phase commit operations. The rationale behind this is that if operations not requiring two-phase commit processing fail, it might be pointless to perform operations that do require two-phase commit processing.

Overview of IMS transaction layout

Figure 4 provides an overview of IMS transaction layout.

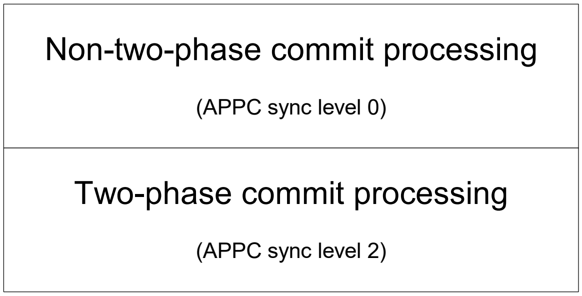

Figure 4: *Overview of IMS Transaction Layout*

Designing an IMS two-phase commit transaction

When designing an IMS two-phase commit transaction, structure the transaction as follows:

1. Begin the IMS transaction by performing standard Orbix Mainframe IMS client initialization.
2. Issue an initial IMS `Get Unique` call.
3. Perform the following loop until the IMS status code indicates that there are no more segments:
   - Perform operations that do not require two-phase commit. If any of the operations fail, skip the two-phase commit processing.
   - Call `ORBTXNB` to indicate the start of two-phase commit processing.
   - Call `ORBEXEC` (perhaps multiple times) to send an update to a remote server. If any of the calls fail, call rollback and skip any updates to local resources.
   - Make updates to local resources, such as updating a local database. If any of the local updates fail, call rollback.
   - Call `ORBTXNE` to indicate the end of the two-phase commit work.
   - Perform any post two-phase commit work, such as sending a message back to the user.
   - Issue another `Get Unique` call.
4. End loop.

Commit or rollback scenarios

When an IMS transaction makes updates to resources (that is, local databases or remote CORBA servers) via the client adapter, the updates are not made permanent until the two-phase commit has been successfully processed. The trigger for starting the two-phase commit is when the IMS transaction finishes its processing. The transaction does not immediately end. Instead, it waits for the results of two-phase commit to decide whether it should commit or roll back its updates to local resources.

The client adapter sends a "prepare" message to each remote server that has been updated from the IMS transaction. Each server returns a vote to the client adapter. A vote of "commit" indicates the remote server is willing to commit its updates. A vote of "rollback" indicates the remote server has a problem and that it wants to roll back the update.

The various scenarios that might arise are as follows:

- Successful two-phase commit

  If all returned votes are "commit", the client adapter calls the IBM API `SRRCMIT`, to inform IMS that all remote servers are willing to commit their updates. If the return code from `SRRCMIT` is `0`, the client adapter sends a "commit" message to each remote server. Two-phase commit processing is then completed and all resources are updated.

- Rollback two-phase commit—Scenario 1

  If the client adapter receives at least one returned vote of "rollback", all updates should be rolled back. The client adapter calls the IBM API `SRRBACK`, to inform IMS that there are problems. This causes the IMS transaction to abend with a `U0711` code to roll back any local updates.

- Rollback two-phase commit—Scenario 2

  If all returned votes are "commit", the client adapter calls the IBM API `SRRCMIT`, to inform IMS that all remote servers are willing to commit their updates. If the return code from `SRRCMIT` is not `0`, the client adapter sends a "rollback" message to each server. In this case, this means that a resource other than the remote servers has voted "rollback".

- Rollback two-phase commit—Scenario 3

  If the IMS transaction makes an update to a remote server, and the update fails (because, for example, the server is not running), the transaction calls "rollback" to undo any updates. The client adapter receives the rollback signal and sends a "rollback" message to each server.

Example of the DATACL module

The following is an example of the IMS `DATACL` module:

Example 7: *The IMS DATACL Demonstration (Sheet 1 of 10)*

```
****************************************************************
*
* (C) Copyright 1997-2021 Micro Focus or one of its affiliates.
*
* The only warranties for products and services of
* Micro Focus and its affiliates and licensors
* ("Micro Focus") are as may be set forth in the express
* warranty statements accompanying such products and
* services. Nothing herein should be construed as
* constituting an additional warranty. Micro Focus shall not
* be liable for technical or editorial errors or omissions
* contained herein. The information contained herein is
* subject to change without notice.
*
* Except as specifically indicated otherwise, this document
* contains confidential information and a valid license is
* required for possession, use or copying. If this work is
* provided to the U.S. Government, consistent with FAR
* 12.211 and 12.212, Commercial Computer Software, Computer
* Software Documentation, and Technical Data for Commercial
* Items are licensed to the U.S. Government under vendor's
* standard commercial license.
*
****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.                   DATACL.

 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 INPUT-OUTPUT SECTION.
 DATA DIVISION.

 WORKING-STORAGE SECTION.

 COPY DATA.
 COPY CORBA.
 COPY WSIMSCL.

1  01 WS-DATA-URLA                  PICTURE X(26) VALUE
       "corbaloc:rir:/DataObjectA ".
1  01 WS-DATA-URLB                  PICTURE X(26) BINARY
       "corbaloc:rir:/DataObjectB ".
```

Example 7: *The IMS DATACL Demonstration (Sheet 2 of 10)*

```
 01 WS-DATA-URLA-LENGTH           PICTURE 9(9) BINARY
                                  VALUE 26.
 01 WS-DATA-URLB-LENGTH           PICTURE 9(9) BINARY
                                  VALUE 26.
 01 WS-DATA-URL-PTR               POINTER
                                  VALUE NULL.
 01 DATA-OBJA                     POINTER
                                  VALUE NULL.
 01 DATA-OBJB                     POINTER
                                  VALUE NULL.
 01 ARG-LIST                      PICTURE X(80)
                                  VALUE SPACES.
 01 ARG-LIST-LEN                  PICTURE 9(09) BINARY
                                  VALUE 0.
 01 ORB-NAME                      PICTURE X(10)
                                  VALUE "twopc_orb".
 01 ORB-NAME-LEN                  PICTURE 9(09) BINARY
                                  VALUE 10.

 01 RESULTS-AREA.
    03 READ-RESULT-A              PICTURE 9
                                  VALUE 0.
    03 UPDATE-RESULT-A            PICTURE 9
                                  VALUE 0.
    03 READ-RESULT-B              PICTURE 9
                                  VALUE 0.
    03 UPDATE-RESULT-B            PICTURE 9
                                  VALUE 0.

 COPY LSIMSPCB.
 PROCEDURE DIVISION USING LS-IO-PCB, LS-ALT-PCB.
****************************************************************
* 0000-MAINLINE.
*
2 * Process a two-phase commit transaction. The general flow of
* the transaction is as follows:
*
*   initial Get Unique (GU) + initialize
*   while IO-PCB status is spaces
      begin a transaction (ORBTXNB)
*         read a value from "server A" (ORBEXEC)
*         send an update to "server A" (ORBEXEC)
*         read a value from "server B" (ORBEXEC)
*         send an update to "server B" (ORBEXEC)
*         if any request failed, rollback (ROLB)
```

Example 7: *The IMS DATACL Demonstration (Sheet 3 of 10)*

```
   *       end the transaction (ORBTXNE)
   *       insert (ISRT) a message to the IMS message queue
   *       issue another GU - which triggers the two-phase commit
16 *    end-while
   *
   ****************************************************************
    0000-MAINLINE.

        PERFORM 1000-INITIALIZE.
        PERFORM 2000-PROCESS-TRANSACTION
            UNTIL LS-IOPCB-STATUS-CODE NOT EQUAL SPACES.
        PERFORM 3000-TERMINATE.

        GOBACK.

   ****************************************************************
   * 1000-INITIALIZE
   *
   * Issue the initial Get Unique. Get references to "server A"
   * and "server B".
   *
   ****************************************************************
   1000-INITIALIZE.

       PERFORM 2050-GET-UNIQUE.

2      CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.

   *  ORB initialization
        DISPLAY "Initializing the ORB".
3       CALL "ORBARGS"   USING ARG-LIST
                               ARG-LIST-LEN
                               ORB-NAME
                               ORB-NAME-LEN.
        SET WS-ORBARGS TO TRUE.
        PERFORM CHECK-STATUS.

   *  Register interface Twopc
        DISPLAY "Registering the Interface".
4       CALL "ORBREG"   USING DATA-INTERFACE-INTERFACE.
        SET WS-ORBREG TO TRUE.
        PERFORM CHECK-STATUS.

   * Set the COBOL pointer to point to the URLA string
5       CALL  "STRSET"   USING WS-DATA-URL-PTR
```

Example 7: *The IMS DATACL Demonstration (Sheet 4 of 10)*

```
                             WS-DATA-URLA-LENGTH
                             WS-DATA-URLA.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

* Obtain object A reference from the url
6    CALL "STRTOOBJ"  USING WS-DATA-URL-PTR
                             DATA-OBJA.
     SET WS-STRTOOBJ TO TRUE.
     PERFORM CHECK-STATUS.

* Releasing the memory
     CALL "STRFREE"   USING WS-DATA-URL-PTR.
     SET WS-STRFREE TO TRUE.
     PERFORM CHECK-STATUS.

* Set the COBOL pointer to point to the URLB string
7    CALL  "STRSET"   USING WS-DATA-URL-PTR
                             WS-DATA-URLB-LENGTH
                             WS-DATA-URLB.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

* Obtain object B reference from the url
8    CALL "STRTOOBJ"  USING WS-DATA-URL-PTR
                             DATA-OBJB.
     SET WS-STRTOOBJ TO TRUE.
     PERFORM CHECK-STATUS.

* Releasing the memory
     CALL "STRFREE"   USING WS-DATA-URL-PTR.
     SET WS-STRFREE TO TRUE.
     PERFORM CHECK-STATUS.

****************************************************************
* 2000-PROCESS-TRANSACTION
*
* Begin a two-phase commit transaction by calling ORBTXNB.
* Read a value from "server A". Add 1 to the value and
* update "server A" with the new value. Read a value from
* "server B". Add 1 to the value and update "server B" with
* the new value.
*
* Check that all requests were successful. If not, request
* a rollback.
```

Example 7: *The IMS DATACL Demonstration (Sheet 5 of 10)*

```
*
* End the two-phase commit transaction by calling ORBTXNE.
*
* If all requests were successful, the next GU call will
* trigger the two-phase commit.
*
****************************************************************
2000-PROCESS-TRANSACTION.

*  Begin a transaction.
9      CALL "ORBTXNB".
       SET WS-ORBTXNB TO TRUE.
       PERFORM CHECK-STATUS.
       DISPLAY "Two-phase commit transaction begins".

       PERFORM 2005-READ-VALUE-A.

       IF READ-RESULT-A IS EQUAL TO 1
          PERFORM 2010-UPDATE-VALUE-A.

       IF UPDATE-RESULT-A IS EQUAL TO 1
          PERFORM 2015-READ-VALUE-B.

       IF READ-RESULT-B IS EQUAL TO 1
          PERFORM 2020-UPDATE-VALUE-B.

       IF READ-RESULT-A   IS EQUAL TO 1 AND
          UPDATE-RESULT-A IS EQUAL TO 1 AND
          READ-RESULT-B   IS EQUAL TO 1 AND
          UPDATE-RESULT-B IS EQUAL TO 1
          MOVE 42 TO OUT-LL OF OUTPUT-AREA
          MOVE "Two-phase commit transaction completed" TO
                OUTPUT-LINE OF OUTPUT-AREA
          DISPLAY "All updates successful -"
          DISPLAY "request commit"
       ELSE
          MOVE 44 TO OUT-LL OF OUTPUT-AREA
          MOVE "A problem was encountered - rolling back" TO
               OUTPUT-LINE OF OUTPUT-AREA
          DISPLAY "Some updates were not successful -"
          DISPLAY "request rollback"
14        PERFORM 2070-ROLLBACK.

*  End the transaction.
15     CALL "ORBTXNE".
```

Example 7: *The IMS DATACL Demonstration (Sheet 6 of 10)*

```
     SET WS-ORBTXNE TO TRUE.
     PERFORM CHECK-STATUS.
     DISPLAY "Two-phase commit transaction ends".

     PERFORM 2060-INSERT.

     PERFORM 2050-GET-UNIQUE.

****************************************************************
* 2005-READ-VALUE-A
*
* Read a value from "server A".
*
****************************************************************
2005-READ-VALUE-A.

     SET READ-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.
```

10

```
     CALL "ORBEXEC"    USING DATA-OBJA
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO READ-RESULT-A
        DISPLAY "Successfully read a value from server A:  "
                IDL-VALUE OF READ-OPERATION-ARGS.

****************************************************************
* 2010-UPDATE-VALUE-A
*
* Request that "server A" update a value.
*
****************************************************************
2010-UPDATE-VALUE-A.

     MOVE IDL-VALUE OF READ-OPERATION-ARGS
       TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     ADD 1 TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     DISPLAY "New value for server A:  " IDL-VALUE OF
             WRITE-OPERATION-ARGS.
```

Example 7: *The IMS DATACL Demonstration (Sheet 7 of 10)*

```
     SET WRITE-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

11   CALL "ORBEXEC"    USING DATA-OBJA
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO UPDATE-RESULT-A
        DISPLAY "Server A has successfully updated the value".

****************************************************************
* 2015-READ-VALUE-B
*
* Read a value from "server B".
*
****************************************************************
2015-READ-VALUE-B.

     SET READ-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

12   CALL "ORBEXEC"    USING DATA-OBJB
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.
     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO READ-RESULT-B
        DISPLAY "Successfully read a value from server B:  "
                IDL-VALUE OF READ-OPERATION-ARGS.

****************************************************************
* 2020-UPDATE-VALUE-B
*
* Request that "server B" update a value.
*
****************************************************************
```

Example 7: *The IMS DATACL Demonstration (Sheet 8 of 10)*

```
2020-UPDATE-VALUE-B.

     MOVE IDL-VALUE OF READ-OPERATION-ARGS
       TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     ADD 1 TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     DISPLAY "New value for server B:  " IDL-VALUE OF
             WRITE-OPERATION-ARGS.

     SET WRITE-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

13   CALL "ORBEXEC"    USING DATA-OBJB
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO UPDATE-RESULT-B
        DISPLAY "Server B has successfully updated the value".

*****************************************************************
* 2050-GET-UNIQUE
*
* Issue a GET UNIQUE call.
*
*****************************************************************
2050-GET-UNIQUE.

     CALL 'CBLTDLI'   USING GET-UNIQUE,
                            LS-IO-PCB,
                            INPUT-MSG.
     IF LS-IOPCB-STATUS-CODE NOT = SPACES AND
        LS-IOPCB-STATUS-CODE NOT = NO-MORE-MESSAGE
        STRING "SEGMENT READ FAILED with status code error of "
                                    DELIMITED BY SIZE
              LS-IOPCB-STATUS-CODE  DELIMITED BY SIZE
              INTO OUTPUT-LINE OF OUTPUT-AREA
        MOVE 49 TO OUT-LL OF OUTPUT-AREA
        PERFORM WRITE DC-TEXT THRU WRITE-DC-TEXT-END
        GOBACK.

     IF LS-IOPCB-STATUS-CODE NOT = NO-MORE-MESSAGE
```

Example 7: *The IMS DATACL Demonstration (Sheet 9 of 10)*

```
        MOVE SPACES TO OUTPUT-LINE OF OUTPUT-AREA
        STRING "Output from transaction: "  DELIMITED BY SIZE
               IN-TRANCODE OF INPUT-MSG     DELIMITED BY SIZE
               INTO OUTPUT-LINE OF OUTPUT-AREA
        MOVE 38 TO OUT-LL OF OUTPUT-AREA
        PERFORM WRITE DC-TEXT THRU WRITE-DC-TEXT-END.

****************************************************************
* 2060-INSERT.
*
* Issue an INSERT call.
*
****************************************************************
2060-INSERT.

     PERFORM WRITE-DC-TEXT THRU WRITE-DC-TEXT-END.

****************************************************************
* 2070-ROLLBACK.
*
* Issue a ROLLBACK call.
*
****************************************************************
2070-ROLLBACK.

     CALL 'CBLTDLI'  USING ROLB,
                           LS-IO-PCB.

     IF LS-IOPCB-STATUS-CODE NOT = SPACES
        DISPLAY "ROLLBACK FAILED with status code error of "
                LS-IOPCB-STATUS-CODE.

****************************************************************
* 3000-TERMINATE
*
* Release the references to "server A" and "server B".
*
****************************************************************
3000-TERMINATE.

    CALL "OBJREL" USING DATA-OBJA.
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "OBJREL" USING DATA-OBJB.
```

Example 7: *The IMS DATACL Demonstration (Sheet 10 of 10)*

```
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

****************************************************************
* Output IMS segment.
****************************************************************
COPY IMSWRITE.

****************************************************************
* Check Errors Copybook
****************************************************************
COPY CHKCLIMS REPLACING
==GOBACK==
BY
====.
```

Explanation of the DATACL module

The IMS DATACL module can be explained as follows:

1. WS-DATA-URLA and WS-DATA-URLB define corbaloc URL strings in the corbaloc:rir format. These strings identify the servers with which the client is to communicate. The strings can be passed as a parameter to STRTOOBJ to allow the client to retrieve an object reference to the server. See point **6** about STRTOOBJ for more details.
2. ORBSTAT is called to register the ORBIX-STATUS-INFORMATION block that is contained in the CORBA copybook. Registering the ORBIX-STATUS-INFORMATION block allows the COBOL runtime to populate it with exception information, if necessary.

   You can use the ORBIX-STATUS-INFORMATION data item (in the CORBA copybook) to check the status of any Orbix call. The EXCEPTION-NUMBER numeric data item is important in this case. If this item is 0, it means the call was successful. Otherwise, EXCEPTION-NUMBER holds the system exception number that occurred. You should test this data item after any Orbix call.
3. ORBARGS is called to initialize a connection to the ORB.
4. ORBREG is called to register the IDL interface with the Orbix COBOL runtime.
5. STRSET is called to create an unbounded string to which the stringified object reference to server 'A' is copied.

6. `STRTOOBJ` is called to create an object reference to the server 'A' object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string in the form `corbaloc:rir:/DataObjectA` (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

7. `STRSET` is called to create an unbounded string to which the stringified object reference to server 'B' is copied.
8. `STRTOOBJ` is called to create an object reference to the server 'B' object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string in the form `corbaloc:rir:/DataObjectB` (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.
9. `ORBTXNB` is called to indicate the start of two-phase commit processing. The next APPC conversation with the client adapter, which is established at the next call to `ORBEXEC`, will be at sync level 2.
10. `ORBEXEC` is called in this paragraph to read a value from server 'A'.
11. `ORBEXEC` is called in this paragraph to update a value from server 'A'. Server 'A' will log that an update has been requested, but make no actual changes.
12. `ORBEXEC` is called in this paragraph to read a value from server 'B'.
13. `ORBEXEC` is called in this paragraph to update a value from server 'B'. Server 'B' will log that an update has been requested, but make no actual changes.
14. If any call to `ORBEXEC` was unsuccessful, ask IMS to initiate rollback processing to undo the updates made by the servers. Server 'A' and 'B' will destroy the log that was holding the potential updates. No actual updates will be made.
15. `ORBTXNE` is called to indicate the end of two-phase commit processing. This requests that APPC deallocates the conversation. However, the actual deallocation does not occur until the two-phase commit processing has completed.

16. The IMS transaction ends. This triggers the start of two-phase commit processing. The client adapter is notified that the IMS transaction has initiated two-phase commit processing. The client adapter requests that server 'A' and server 'B' prepare their updates. Each server replies to the client adapter that they are either able or unable to commit the update. If either server replies that they are unable to commit the update, each server is asked to roll back and destroy the log that was holding the potential update. If both servers reply that they are able to commit the changes, the client adapter requests each server to commit their changes. The APPC conversation between IMS and the client adapter deallocates, and two-phase commit processing ends.

Location of the DATACL module

You can find a complete version of the IMS `DATACL` client module in *`orbixhlq`*`.DEMO.IMS.CBL.SRC(DATACL)`.

Building the Client

JCL to run the Orbix IDL compiler

Before you can build the client, you must run the Orbix IDL compiler on the IDL supplied in *orbixhlq*.DEMO.IDL(DATA). Sample JCL to do this can be found in *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(DATAIDL).

JCL to build the client

Sample JCL used to compile and link the client can be found in *orbixhlq*.DEMO.IMS.CBL.BLD.JCLLIB(DATACB).

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.IMS.CBL.LOADLIB(DATACL).

Building the Servers

JCL to build the servers

Sample JCL used run the IDL compiler, and compile and link the servers can be found in *orbixhlq*.DEMO.CPP.BLD.JCLLIB(DATASV).

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.CPP.LOADLIB(DATASV).

Preparing the Client to Run in IMS

Overview

This section describes the required steps to allow the client to run in an IMS region. These steps assume you want to run the IMS client against a batch server.

Steps

The steps to enable the client to run in an IMS region are:

Step	Action
1	Define a transaction to IMS.
2	Provide the IMS client load module to the IMS region.
3	Start the locator, node daemon, and RRS OTSTM on the server host.
4	Start the batch servers.
5	Customize the batch server IORs.
6	Configure and run the client adapter.

Step 1—Define a transaction to IMS

A transaction definition must be created for the client, to allow it to run in IMS. The following is the transaction definition for the supplied demonstration:

```
    APPLCTN  GPSB=DATACL,                                              x
             PGMTYPE=(TP,,2),                                          x
             SCHDTYP=PARALLEL                                          x
             LANG=COBOL
    TRANSACT CODE=DATACL,                                              x
             EDIT=(ULC)
```

Step 2—Provide client load module to IMS region

Ensure that the `*orbixhlq*.DEMO.IMS.CBL.LOADLIB` PDS is added to the STEPLIB for the IMS region that is to run the transaction.

Step 3—Start locator, node daemon, and RRS OTSTM on server

This step assumes that you intend running the IMS client against the demonstration batch server.

In this case, you must start all of the following on the batch server host (if they have not already been started):

1. Start the locator daemon by submitting `orbixhlq.JCLLIB(LOCATOR)`.
2. Start the node daemon by submitting `orbixhlq.JCLLIB(NODEDAEM)`.
3. Start the RRS OTSTM server by submitting `orbixhlq.JCLLIB(OTSTM)`.

See "Running the Server and Client" on page 45 for more details of running the locator and node daemon on the batch server host.

See the chapter on Using OTS RRS Transaction Manager in the *Mainframe OTS Guide* for more details of running the RRS OTSTM server.

Step 4—Start batch servers

This step assumes that you intend running the IMS client against the demonstration batch servers.

Submit the `orbixhlq.DEMO.CPP.RUN.JCLLIB(DATAA)` and `orbixhlq.DEMO.CPP.RUN.JCLLIB(DATAB)` JCL to start the batch servers.

Step 5—Customize batch server IORs

When you run the demonstration batch servers they publish their IORs to `orbixhlq.DEMO.IORS(DATAA)` and `orbixhlq.DEMO.IORS(DATAB)`.

The demonstration IMS client needs to use these IORs to contact the demonstration batch servers. The demonstration IMS client obtains the object reference for the demonstration batch servers in the form of a corbaloc URL string. A corbaloc URL string can take different formats. For the purposes of this demonstration, the corbalocs take the form `corbaloc:rir:/DataObjectA` and `corbaloc:rir:/DataObjectB`.

This form of the corbaloc URL string requires the use of the configuration variables, `initial_references:DataObjectA:reference` and `initial_references:DataObjectB:reference`, in the configuration domain. When you submit the JCL in `orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB (DATAIORS)`, it automatically adds these configuration entries to the configuration domain:

```
initial_references:DataObjectA:reference = "IOR…";
initial_references:DataObjectB:reference = "IOR…";
```

The IOR values are taken from *orbixhlq*.DEMO.IORS(DATAA) and *orbixhlq*.DEMO.IORS(DATAB).

See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

Step 6—Configure and run client adapter

The client adapter must now be configured before you can start the client (the IMS transaction). See the *IMS Adapters Administrator's Guide* for details of how to configure the client adapter.

When you have configured the client adapter, you can run it by submitting *orbixhlq*.JCLLIB(IMSCA).

Note: See "Running an IMS Two-Phase Commit Client against Batch Servers" on page 122 for details of how to run the sample two-phase commit client demonstration.

Running the Demonstrations

Overview

This section provides a summary of what you need to do to successfully run the supplied demonstrations.

In this section

This section discusses the following topics:

Running a Batch Client against an IMS Server

Overview

This subsection describes what you need to do to successfully run the demonstration batch client against the demonstration IMS server. It also provides an overview of the output produced.

Steps

The steps to run the demonstration IMS server against the demonstration batch client are:

1. Ensure that all the steps in "Preparing the Server to Run in IMS" on page 81 have been successfully completed.
2. Run the batch client as described in "Running the Server and Client" on page 45.

IMS server output

The IMS server sends the following output to the IMS region:

```
Simple::call_me:IDL:Simple/SimpleObject:1.0 invoked
```

Batch client output

The batch client produces the following output:

```
Initializing the ORB
Registering the Interface
Reading object reference from file
invoking Simple::call_me:IDL:Simple/SimpleObject:1.0
Simple demo complete.
```

Running an IMS Client against a Batch Server

Overview

This subsection describes what you need to do to successfully run the demonstration IMS client against the demonstration batch server. It also provides an overview of the output produced.

Steps

The steps to run the demonstration IMS client against the demonstration batch server are:

1. Ensure that all the steps in "Preparing the Client to Run in IMS" on page 93 have been successfully completed.
2. Run the IMS client by entering the transaction name, `SIMPLECL`, in the relevant IMS region.

IMS client output

The IMS client sends the following output to the IMS region:

```
Initializing the ORB
Registering the Interface
invoking Simple::call_me:IDL:Simple/SimpleObject:1.0
Simple demo complete.
```

The IMS client sends the following output to the IMS message queue:

```
Output from transaction: SIMPLECL
Simple Transaction completed
```

Batch server output

The batch server produces the following output:

```
Initializing the ORB
Registering the Interface
Creating the Object
Writing object reference to file
Giving control to the ORB to process Requests
Simple::call_me:IDL:Simple/SimpleObject:1.0 invoked
```

Running an IMS Two-Phase Commit Client against Batch Servers

Overview

This subsection describes what you need to do to successfully run the demonstration IMS two-phase commit client against the demonstration batch servers. It also provides an overview of the output produced.

Note: For instructions on recovery processing for any unsuccessful runs of an application, see *orbixhlq*.DEMO.IMS.CBL.README(DATACL).

Steps

The steps to run the demonstration IMS two-phase commit client against the demonstration batch servers are:

1. Ensure that all the steps in "Preparing the Client to Run in IMS" on page 116 have been successfully completed.
2. Run the IMS client by entering the transaction name, DATACL, in the relevant IMS region.

IMS client output

The IMS client sends the following output to the IMS region:

```
Initializing the ORB
Registering the Interface
Two-phase commit transaction begins
Invoking: read:IDL:Data:1.0
Successfully read a value from server A: 0000000001
New value for server A: 0000000002
Invoking: write:IDL:Data:1.0
Server A has successfully updated the value.
Invoking: read:IDL:Data:1.0
Successfully read a value from server B: 0000000001
New value for server B: 0000000002
Invoking: write:IDL:Data:1.0
Server B has successfully updated the value.
All updates are successful -
request commit
Two-phase commit transaction ends
```

The IMS client sends the following output to the IMS message queue:

```
Output from transaction:  DATACL
Two-phase commit transaction completed
```

Batch server 'A' output

Batch server 'A' produces the following output:

```
OTS Recovery Demo Server
Initializing the ORB
Server ID is A
IOR file is  DD:IORS(DATAA)
Data file is DD:DATA(DATAA)
Log file is DD:DATA(LOGA)
Resolving TransactionCurrent
Resolving RootPOA
Creating POA with REQUIRES OTS Policy
Creating POA with lifespan policy of PERSISTENT
Creating POA with an ID assignment of USER
Creating Data servant and object
Creating POA for Resource objects
Reading data from file DD:DATA(DATAA)
Value is 1
Writing object reference to DD:IORS(DATAA)
Activation POA for Data object
Data servant read() called
Read-only access: not registering Resoure object
Current value is 1
Data servant write() called
Getting coordinator for current transaction
Getting Transaction Identifier
Creating Resource servant
Activating Resource object
Registering Resource object with coordinator
Activating the Resource POA
Setting value to 2
Resource servant prepare() called
Voting to commit the transaction
Writing prepare record
Resource servant commit() called
Writing data to file DD:DATA(DATAA)
Deleting prepare record
Deactivating Resource object
Resource servant destructed
```

Batch server 'B' output

Batch server 'B' produces the following output:

```
OTS Recovery Demo Server
Initializing the ORB
Server ID is B
IOR file is  DD:IORS(DATAB)
Data file is DD:DATA(DATAB)
Log file is DD:DATA(LOGB)
Resolving TransactionCurrent
Resolving RootPOA
Creating POA with REQUIRES OTS Policy
Creating POA with lifespan policy of PERSISTENT
Creating POA with an ID assignment of USER
Creating Data servant and object
Creating POA for Resource objects
Reading data from file DD:DATA(DATAB)
Value is 1
Writing object reference to DD:IORS(DATAB)
Activation POA for Data object
Data servant read() called
Read-only access: not registering Resoure object
Current value is 1
Data servant write() called
Getting coordinator for current transaction
Getting Transaction Identifier
Creating Resource servant
Activating Resource object
Registering Resource object with coordinator
Activating the Resource POA
Setting value to 2
Resource servant prepare() called
Voting to commit the transaction
Writing prepare record
Resource servant commit() called
Writing data to file DD:DATA(DATAB)
Deleting prepare record
Deactivating Resource object
Resource servant destructed
```

Getting Started in CICS

This chapter introduces CICS application programming with Orbix, by showing how to use Orbix to develop both a CICS COBOL client and a CICS COBOL server. It also provides details of how to subsequently run the CICS client against a COBOL batch server, and how to run a COBOL batch client against the CICS server. Additionally, this chapter shows how to develop a CICS client that supports two-phase commit transactions.

In this chapter

This chapter discusses the following topics:

Note: The client and server examples provided in this chapter respectively require use of the CICS client and server adapters that are supplied as part of Orbix Mainframe. See the *CICS Adapters Administrator's Guide* for more details about these CICS adapters.

Overview

Introduction

This section provides an overview of the main steps involved in creating the following Orbix COBOL applications:

- CICS server
- CICS client
- CICS two-phase commit client

It also introduces the following COBOL demonstrations that are supplied with your Orbix Mainframe installation, and outlines where you can find the various source code and JCL elements for them:

- `SIMPLE` CICS server
- `SIMPLE` CICS client
- `DATACL` CICS two-phase commit client

Steps to create an application

The main steps to create an Orbix COBOL CICS application are:

1. "Developing the Application Interfaces" on page 135.
2. "Developing the CICS Server" on page 145.
3. "Developing the CICS Client" on page 159.
4. "Developing the CICS Two-Phase Commit Client" on page 170.

For the purposes of illustration this chapter demonstrates how to develop both an Orbix COBOL CICS client and an Orbix COBOL CICS server. It then describes how to run the CICS client and CICS server respectively against a COBOL batch server and a COBOL batch client. Additionally, this chapter describes how to develop an Orbix COBOL two-phase commit CICS client, and run it against two C++ servers. The supplied demonstrations do not reflect real-world scenarios requiring Orbix Mainframe, because the client and server are written in the same language and running on the same platform.

The demonstration CICS server

The Orbix COBOL server developed in this chapter runs in a CICS region. It implements a simple persistent POA-based object. It accepts and processes requests from an Orbix COBOL batch client that uses the object interface, SimpleObject, to communicate with the server via the CICS server adapter. The CICS server uses the Internet Inter-ORB Protocol (IIOP), which runs over TCP/IP, to communicate with the batch client.

The demonstration CICS client

The Orbix COBOL client developed in this chapter runs in a CICS region. It uses the clearly defined object interface, `SimpleObject`, to access and request data from an Orbix COBOL batch server that implements a simple persistent `SimpleObject` object. When the client invokes a remote operation, a request message is sent from the client to the server via the client adapter. When the operation has completed, a reply message is sent back to the client again via the client adapter. The CICS client uses IIOP to communicate with the batch server.

The demonstration CICS two-phase commit client

The Orbix COBOL two-phase commit client developed in this chapter runs in a CICS region. It uses the clearly defined object interface, `Data`, to access and update data from two Orbix C++ batch servers. When the client invokes a remote operation, a request message is sent from the client to one of the servers via the client adapter. When the operation has completed, a reply message is sent back to the client again via the client adapter. The CICS client uses IIOP to communicate with the batch servers.

Supplied code and JCL for CICS application development

All the source code and JCL components needed to create and run the CICS `SIMPLE` server and client demonstrations have been provided with your installation. Apart from site-specific changes to some JCL, these do not require editing.

Table 11 provides a summary of these code elements and JCL components (where *`orbixhlq`* represents your installation's high-level qualifier).

Table 11: *Supplied Code and JCL (Sheet 1 of 5)*

Location	Description
orbixhlq.DEMO.IDL(SIMPLE)	This is the supplied IDL for the simple CICS client and server.
orbixhlq.DEMO.IDL(DATA)	This is the supplied IDL for the CICS two-phase commit client.

Table 11: *Supplied Code and JCL (Sheet 2 of 5)*

Location	Description
orbixhlq.DEMO.CICS.CBL.SRC (SIMPLESV)	This is the source code for the CICS server mainline module, which is generated when you run the JCL in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL). (The CICS server mainline code is not shipped with the product. You must run the SIMPLIDL JCL to generate it.)
orbixhlq.DEMO.CICS.CBL.SRC (SIMPLES)	This is the source code for the CICS server implementation module.
orbixhlq.DEMO.CICS.CBL.SRC (SIMPLECL)	This is the source code for the CICS simple client module.
orbixhlq.DEMO.CICS.CBL.SRC (DATACL)	This is the source code for the CICS two-phase commit client module.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPLIDL)	This JCL runs the Orbix IDL compiler. See "Orbix IDL Compiler" on page 138 for more details of this JCL and how to use it.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (DATAIDL)	This JCL runs the Orbix IDL compiler for the CICS two-phase commit client.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPLESB)	This JCL compiles and links the CICS server mainline and CICS server implementation modules to create the SIMPLE server program.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPBDSB)	This JCL compiles and links the CICS server mainline and CICS server implementation modules to create the SIMPLE server program when using a COBOL compiler later than 4.2.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPLECB)	This JCL compiles the CICS simple client module to create the SIMPLE client program.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMBPDCB)	This JCL compiles the CICS simple client module to create the SIMPLE client program when using a COBOL compiler later than 4.2.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (DATACB)	This JCL compiles the CICS two-phase commit client module.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPLREG)	This JCL registers the IDL in the Interface Repository.

Table 11: *Supplied Code and JCL (Sheet 3 of 5)*

Location	Description
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (SIMPLIOR)	This JCL obtains the CICS server's IOR (from the CICS server adapter). A client of the CICS server requires the CICS server's IOR, to locate the server object.
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (UPDTCONF)	This JCL adds the following configuration entry to the configuration member: `initial_references:SimpleObject:reference="IOR…";` This configuration entry specifies the IOR that the CICS client uses to contact the batch server. The IOR that is set as the value for this configuration entry is the IOR that is published in *orbixhlq*.DEMO.IORS(SIMPLE) when you run the batch server. The object reference for the server is represented to the demonstration CICS client as a corbaloc URL string in the form `corbaloc:rir:/SimpleObject`. This form of corbaloc URL string requires the use of the `initial_references:SimpleObject:reference="IOR…"` configuration entry. Other forms of corbaloc URL string can also be used (for example, the IIOP version, as demonstrated in the nested sequences demonstration supplied with your product installation). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

Table 11: *Supplied Code and JCL (Sheet 4 of 5)*

Location	Description

orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB (DATAIORS)	This JCL adds the following configuration entries to the configuration member:
	`initial_references:DataObjectA:reference="IOR…";`
	`initial_references:DataObjectB:reference="IOR…";`
	These configuration entries specify the IORs that the CICS two-phase commit client uses to contact the C++ batch servers. The IORs that are set as the value for these configuration entries are the IORs that are published in *orbixhlq*.DEMO.IORS(DATAA) and *orbixhlq*.DEMO.IORS(DATAB) when you run the C++ batch servers.
	The object references for the servers are represented to the demonstration CICS two-phase commit client as corbaloc URL strings in the form `corbaloc:rir:/DATAObjectA` and `corbaloc:rir:/DATAObjectB`. This form of corbaloc URL string requires the use of the `initial_references:DataObjectA:reference="IOR…"` and `initial_references:DataObjectB:reference="IOR…"` configuration items.

orbixhlq.JCLLIB(CICSCA)	This JCL runs the CICS client adapter.
orbixhlq.JCLLIB(CICSA)	This JCL runs the CICS server adapter.
orbixhlq.DEMO.CPP.BLD.JCLLIB (DATASV)	This JCL builds the C++ servers for the CICS two-phase commit client.
orbixhlq.DEMO.CPP.BLD.JCLLIB (DATAA)	This JCL runs the C++ server 'A' for the CICS two-phase commit client.
orbixhlq.DEMO.CPP.BLD.JCLLIB (DATAB)	This JCL runs the C++ server 'B' for the CICS two-phase commit client.
orbixhlq.DEMO.CPP.GEN	This PDS contains generated stub code for the C++ servers.
orbixhlq.DEMO.CPP.H	This PDS contains C++ header files.
orbixhlq.DEMO.CPP.HH	This PDS contains IDL generated header files.
orbixhlq.DEMO.CPP.LOADLIB	This PDS contains the C++ server module for the two-phase commit CICS client.

Table 11: *Supplied Code and JCL (Sheet 5 of 5)*

Location	Description
orbixhlq.DEMO.CPP.SRC	This PDS contains the C++ server module source code for the two-phase commit CICS client.
orbixhlq.DEMO.CPP.TWOPCA	This PDS contains the data store for the two-phase commit C++ server 'A'.
orbixhlq.DEMO.CPP.TWOPCB	This PDS contains the data store for the two-phase commit C++ server 'B'.

Supplied copybooks

Table 12 provides a summary in alphabetic order of the various copybooks supplied with your product installation that are relevant to CICS application development. Again, *orbixhlq* represents your installation's high-level qualifier.

Table 12: *Supplied Copybooks (Sheet 1 of 3)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(CERRSMFA)	This is relevant to CICS servers. It contains a COBOL paragraph that can be called by the CICS server, to check if a system exception has occurred and report it.
orbixhlq.INCLUDE.COPYLIB(CHKCLCIC)	This is relevant to CICS clients only. It contains a COBOL paragraph that has been translated via the CICS TS 1.3 translator. This paragraph can be called by the client, to check if a system exception has occurred and report it.
orbixhlq.INCLUDE.COPYLIB(CHKCICS)	This is relevant to CICS clients only. It contains the version of the CHKCLCIC member before it was translated via the CICS TS 1.3 translator. It is used by the CICSTRAN job to compile the CHKCICS member, using another version of the CICS translator.
orbixhlq.INCLUDE.COPYLIB(CICWRITE)	This is relevant to CICS clients only. It contains a COBOL paragraph that has been translated by the CICS TS 1.3 translator. This paragraph can be called by the client, to write any messages raised by the supplied demonstrations to the CICS terminal.

Table 12: *Supplied Copybooks (Sheet 2 of 3)*

Location	Description
orbixhlq.INCLUDE.COPYLIB(CORBA)	This is relevant to both CICS clients and servers. It contains various Orbix COBOL definitions, such as `REQUEST-INFO` used by the `COAREQ` function, and `ORBIX-STATUS-INFORMATION` which is used to register and report system exceptions raised by the COBOL runtime.
orbixhlq.INCLUDE.COPYLIB(CORBATYP)	This is relevant to both CICS clients and servers. It contains the COBOL typecode representations for IDL basic types.
orbixhlq.INCLUDE.COPYLIB(WSCICSCL)	This is relevant to CICS clients only. It contains a COBOL data definition that defines the format of the message that can be written by the paragraph contained in *orbixhlq*.INCLUDE.COPYLIB(CICWRITE).
orbixhlq.INCLUDE.COPYLIB(WSCICSSV)	This is relevant to CICS servers only. It is used by the server implementation, to obtain access to the EXEC interface block (EIB). This copybook contains just one line, as follows: `01 WS-EIB-POINTER   USAGE IS POINTER VALUE NULL`
orbixhlq.INCLUDE.COPYLIB(WSURLSTR)	This is relevant to clients only. It contains a COBOL representation of the corbaloc URL IIOP string format. A client can call `STRTOOBJ` to convert the URL into an object reference. See "STRTOOBJ" on page 514 for more details.
orbixhlq.DEMO.CICS.CBL.COPYLIB	This PDS is relevant to both CICS clients and servers. It is used to store all CICS copybooks generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. It also contains copybooks with Working Storage data definitions and Procedure Division paragraphs for use with the nested sequences demonstration.

Table 12: *Supplied Copybooks (Sheet 3 of 3)*

Location	Description
`orbixhlq.DEMO.CICS.MFAMAP`	This PDS is relevant to CICS servers only. It is empty at installation time. It is used to store the CICS server adapter mapping member generated when you run the JCL to run the Orbix IDL compiler for the supplied demonstrations. The contents of the mapping member are the fully qualified interface name followed by the operation name followed by the CICS APPC transaction name or CICS EXCI program name (for example, `(Simple/SimpleObject,call_me,SIMPLESV)`. See the *CICS Adapters Administrator's Guide* for more details about generating CICS server adapter mapping members.

Checking JCL components

When creating the CICS simple client or server, or the CICS two-phase commit client, check that each step involved within the separate JCL components completes with a condition code of zero. If the condition codes are not zero, establish the point and cause of failure. The most likely cause is the site-specific JCL changes required for the compilers. Ensure that each high-level qualifier throughout the JCL reflects your installation.

Developing the Application Interfaces

Overview

This section describes the steps you must follow to develop the IDL interfaces for your application. It first describes how to define the IDL interfaces for the objects in your system. It then describes how to run the IDL compiler. Finally it provides an overview of the COBOL copybooks, server source code, and CICS server adapter mapping member that you can generate via the IDL compiler.

Steps to develop application interfaces

The steps to develop the interfaces to your application are:

Step	Action
1	Define public IDL interfaces to the objects required in your system. See “Defining IDL Interfaces” on page 136.
2	Use the `ORXCOPY` utility to copy your IDL files to z/OS (if necessary). See “ORXCOPY Utility” on page 553.
3	Run the Orbix IDL compiler to generate COBOL copybooks, server source, and server mapping member. See “Orbix IDL Compiler” on page 138.

Defining IDL Interfaces

Defining the IDL

The first step in writing any Orbix program is to define the IDL interfaces for the objects required in your system. The following is an example of the IDL for the `SimpleObject` interface that is supplied in *orbixhlq*.DEMO.IDL(SIMPLE):

```
// IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

Explanation of the IDL

The preceding IDL declares a `SimpleObject` interface that is scoped (that is, contained) within the `Simple` module. This interface exposes a single `call_me()` operation. This IDL definition provides a language-neutral interface to the CORBA `Simple::SimpleObject` type.

How the demonstration uses this IDL

For the purposes of the demonstrations in this chapter, the `SimpleObject` CORBA object is implemented in COBOL in the supplied `SIMPLES` server application. The server application creates a persistent server object of the `SimpleObject` type, and publishes its object reference to a PDS member. The client invokes the `call_me()` operation on the `SimpleObject` object, and then exits.

The batch demonstration client of the CICS demonstration server locates the `SimpleObject` object by reading the interoperable object reference (IOR) for the CICS server adapter from *orbixhlq*.DEMO.IORS(SIMPLE). In this case, the CICS server adapter IOR is published to *orbixhlq*.DEMO.IORS(SIMPLE) when you run *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIOR).

The CICS demonstration client of the batch demonstration server locates the `SimpleObject` object by reading the IOR for the batch server from *`orbixhlq`*`.DEMO.IORS(SIMPLE)`. In this case, the batch server IOR is published to *`orbixhlq`*`.DEMO.IORS(SIMPLE)` when you run the batch server. The object reference for the server is represented to the demonstration CICS client as a corbaloc URL string in the form `corbaloc:rir:/SimpleObject`.

Orbix IDL Compiler

The Orbix IDL compiler

This subsection describes how to use the Orbix IDL compiler to generate COBOL copybooks, server source, and the CICS server adapter mapping member from IDL.

Note: If your IDL files are not already contained in z/OS data sets, you must copy them to z/OS before you proceed. You can use the `ORXCOPY` utility to do this. If necessary, see "ORXCOPY Utility" on page 553 for more details.

Note: Generation of COBOL copybooks is relevant to both CICS client and server development. Generation of server source and the CICS server adapter mapping member is relevant only to CICS server development.

Orbix IDL compiler configuration

The Orbix IDL compiler uses the Orbix configuration member for its settings. The `SIMPLIDL` JCL that runs the compiler uses the configuration member *orbixhlq*`.CONFIG(IDL)`. See "Orbix IDL Compiler" on page 315 for more details.

Example of the SIMPLIDL JCL

The following JCL runs the IDL compiler for the CICS `SIMPLE` demonstration:

```
//SIMPLIDL JOB   (),
//          CLASS=A,
//          MSGCLASS=X,
//          MSGLEVEL=(1,1),
//          REGION=0M,
//          TIME=1440,
//          NOTIFY=&SYSUID,
//          COND=(4,LT)
//*-------------------------------------------------------------------
//* Orbix - Generate the COBOL copybooks for the CICS Simple Demo
//*-------------------------------------------------------------------
//          JCLLIB ORDER=(orbixhlq.PROCLIB)
//          INCLUDE MEMBER=(ORXVARS)
//*
//*
```

```
//IDLCBL   EXEC ORXIDL,
//         SOURCE=SIMPLE,
//         IDL=&ORBIX..DEMO.IDL,
//         COPYLIB=&ORBIX..DEMO.CICS.CBL.COPYLIB,
//         IMPL=&ORBIX..DEMO.CICS.CBL.SRC,
//         IDLPARM='-cobol:-S:-TCICS -mfa:-tSIMPLESV:-inf'
//*        IDLPARM='-cobol:-S:-TCICS -mfa:-tSMSV:-inf'
//*        IDLPARM='-cobol'
//IDLMFA   DD DISP=SHR,DSN=&ORBIX..DEMO.CICS.MFAMAP
//IDLTYPEI DD DISP=SHR,DSN=&ORBIX..DEMO.TYPEINFO
```

Explanation of the SIMPLIDL JCL

In the preceding JCL example, the `IDLPARM` lines can be explained as follows:

- The line `IDLPARM='-cobol:-S:-TCICS -mfa:-tSIMPLESV:-inf'` is relevant to CICS server development for EXCI. This line generates:
  - COBOL copybooks via the `-cobol` argument.
  - CICS server mainline code via the `-S:-TCICS` arguments.
  - CICS server adapter mapping member via the `-mfa:-t`*`tran_or_program_name`* arguments.
  - Type information for the `SIMPLE` IDL member via the `-inf` sub-argument to the `-mfa` argument.

  Note: Because CICS server implementation code is already supplied for you, the `-Z` argument is not specified by default.

- The line `IDLPARM='-cobol:-S:-TCICS -mfa:-tSMSV:-inf'` is relevant to CICS server development for APPC. This line generates the same items as the `IDLPARM='-cobol:-S:-TCICS -mfa:-tSIMPLESV:-inf'` line. It is disabled (that is, commented out with an asterisk) by default.
- The line `IDLPARM='-cobol'` is relevant to CICS client development and generates only COBOL copybooks, because it only specifies the `-cobol` argument. It is disabled (that is, commented out) by default.

  Note: The Orbix IDL compiler does not generate COBOL client source code.

For the purposes of the demonstration, the `IDLPARM='-cobol:-S:-TCICS -mfa:-tSIMPLESV:-inf'` line is not commented out (that is, it is not preceded by an asterisk) by default.

Specifying what you want to generate

To indicate which one of the `IDLPARM` lines you want `SIMPLIDL` to recognize, comment out the two `IDLPARM` lines you do not want to use, by ensuring an asterisk precedes those lines. By default, as shown in the preceding example, the JCL is set to generate COBOL copybooks, server mainline code, a CICS server adapter mapping member for EXCI, and type information for the `SIMPLE` IDL member.

See "Orbix IDL Compiler" on page 315 for more details of the Orbix IDL compiler and the JCL used to run it.

Running the Orbix IDL compiler

After you have edited the `SIMPLIDL` JCL according to your requirements, you can run the Orbix IDL compiler by submitting the following job:

```
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL)
```

Generated COBOL Copybooks, Source, and Mapping Member

Overview

This subsection describes all the COBOL copybooks, server source, and CICS server adapter mapping member that the Orbix IDL compiler can generate from IDL definitions.

Note: The generated COBOL copybooks are relevant to both CICS client and server development. The generated source and adapter mapping member are relevant only to CICS server development. The IDL compiler does not generate COBOL client source.

Member name restrictions

Generated copybook, source code, and mapping member names are all based on the IDL member name. If the IDL member name exceeds six characters, the Orbix IDL compiler uses only the first six characters of the IDL member name when generating the other member names. This allows space for appending the two-character `SV` suffix to the name for the server mainline member, while allowing it to adhere to the eight-character maximum size limit for z/OS member names. Consequently, all other member names also use only the first six characters of the IDL member name, followed by their individual suffixes, as appropriate.

How IDL maps to COBOL copybooks

Each IDL interface maps to a group of COBOL data definitions. There is one definition for each IDL operation. A definition contains each of the parameters for the relevant IDL operation in their corresponding COBOL representation. See "IDL-to-COBOL Mapping" on page 237 for details of how IDL types map to COBOL.

Attributes map to two operations (`get` and `set`), and readonly attributes map to a single `get` operation.

Generated COBOL copybooks

Table 13 shows the COBOL copybooks that the Orbix IDL compiler generates, based on the defined IDL.

Table 13: *Generated COBOL Copybooks*

Copybook	JCL Keyword Parameter	Description
`idlmembername`	`COPYLIB`	This copybook contains data definitions that are used for working with operation parameters and return values for each interface defined in the IDL member. The name for this copybook does not take a suffix.
`idlmembernameX`	`COPYLIB`	This copybook contains data definitions that are used by the COBOL runtime to support the interfaces defined in the IDL member. This copybook is automatically included in the `idlmembername` copybook.
`idlmembernameD`	`COPYLIB`	This copybook contains procedural code for performing the correct paragraph for the requested operation. This copybook is automatically included in the `idlmembernameS` source code member.

Generated server source members

Table 14 shows the server source code members that the Orbix IDL compiler generates, based on the defined IDL.

Table 14: *Generated Server Source Code Members*

Member	JCL Keyword Parameter	Description
`idlmembernameS`	`IMPL`	This is the CICS server implementation source code member. It contains stub paragraphs for all the callable operations. This is only generated if you specify both the `-Z` and `-TCICS` arguments with the IDL compiler.
`idlmembernameSV`	`IMPL`	This is the CICS server mainline source code member. This is only generated if you specify both the `-S` and `-TCICS` arguments with the IDL compiler.

Note: For the purposes of this example, the `SIMPLES` server implementation is already provided in your product installation. Therefore, the `-Z` IDL compiler argument used to generate it is not specified in the supplied `SIMPLIDL` JCL. The `SIMPLESV` server mainline is not already provided, so the `-S:-TCICS` arguments used to generate it are specified in the supplied JCL. See "Orbix IDL Compiler" on page 315 for more details of the `-S`, `-Z`, and `-TCICS` arguments to generate CICS server code.

Generated server adapter mapping member

Table 15 shows the CICS server adapter mapping member that the Orbix IDL compiler generates, based on the defined IDL.

Table 15: *Generated CICS Server Adapter Mapping Member*

Copybook	JCL Keyword Parameter	Description
*idlmembername*A	MEMBER	This is a simple text file that determines what interfaces and operations the CICS server adapter supports, and the CICS APPC transaction names, or CICS EXCI program names, to which the CICS server adapter should map each IDL operation.

Location of demonstration copybooks and mapping member

You can find examples of the copybooks, server source, and CICS server adapter mapping member generated for the SIMPLE demonstration in the following locations:

- *orbixhlq*.DEMO.CICS.CBL.COPYLIB(SIMPLE)
- *orbixhlq*.DEMO.CICS.CBL.COPYLIB(SIMPLEX)
- *orbixhlq*.DEMO.CICS.CBL.COPYLIB(SIMPLED)
- *orbixhlq*.DEMO.CICS.CBL.SRC(SIMPLESV)
- *orbixhlq*.DEMO.CICS.CBL.SRC(SIMPLES)
- *orbixhlq*.DEMO.CICS.MFAMAP(SIMPLEA)

Note: Except for the SIMPLES member, none of the preceding elements are shipped with your product installation. They are generated when you run *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL), to run the Orbix IDL compiler.

Developing the CICS Server

Overview

This section describes the steps you must follow to develop the CICS server executable for your application. The CICS server developed in this example will be contacted by the simple batch client demonstration.

Steps to develop the server

The steps to develop the server application are:

Step	Action
1	"Writing the Server Implementation" on page 146.
2	"Writing the Server Mainline" on page 150.
3	"Building the Server" on page 154.
4	"Preparing the Server to Run in CICS" on page 155.

Writing the Server Implementation

The server implementation module

You must implement the server interface by writing a COBOL implementation module that implements each operation in the *idlmembername* copybook. For the purposes of this example, you must write a COBOL module that implements each operation in the SIMPLE copybook. When you specify the -Z and -TCICS arguments with the Orbix IDL compiler, it generates a skeleton server implementation module, in this case called SIMPLES, which is a useful starting point.

Note: For the purposes of this demonstration, the CICS server implementation module, SIMPLES, is already provided for you, so the -Z argument is not specified in the JCL that runs the IDL compiler.

Example of the CICS SIMPLES module

The following is an example of the CICS SIMPLES module:

Example 8: *The CICS SIMPLES Demonstration (Sheet 1 of 3)*

```
****************************************************************
* Identification Division
****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID.             SIMPLES.

ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
COPY SIMPLE.
COPY CORBA.

01 WS-INTERFACE-NAME                          PICTURE X(30).
01 WS-INTERFACE-NAME-LENGTH                   PICTURE 9(09) BINARY
                                              VALUE 30.

****************************************************************
* Procedure Division
****************************************************************
PROCEDURE DIVISION.

1      ENTRY "DISPATCH".
```

Example 8: *The CICS SIMPLES Demonstration (Sheet 2 of 3)*

```
2       CALL "COAREQ"    USING REQUEST-INFO.
        SET WS-COAREQ TO TRUE.
        PERFORM CHECK-STATUS.

3   * Resolve the pointer reference to the interface name which is
    * the fully scoped interface name
    * Note make sure it can handle the max interface name length
        CALL "STRGET"    USING INTERFACE-NAME
                               WS-INTERFACE-NAME-LENGTH
                               WS-INTERFACE-NAME.
        SET WS-STRGET TO TRUE.
        PERFORM CHECK-STATUS.


    ****************************************************************
    * Interface(s)  evaluation:
    ****************************************************************
        MOVE SPACES TO SIMPLE-SIMPLEOBJECT-OPERATION.

        EVALUATE WS-INTERFACE-NAME
        WHEN 'IDL:Simple/SimpleObject:1.0'

4   * Resolve the pointer reference to the operation information
        CALL "STRGET" USING OPERATION-NAME
                            SIMPLE-S-3497-OPERATION-LENGTH
                            SIMPLE-SIMPLEOBJECT-OPERATION
        SET WS-STRGET TO TRUE
        PERFORM CHECK-STATUS
        DISPLAY  "Simple::" SIMPLE-SIMPLEOBJECT-OPERATION
                   "invoked"
        END-EVALUATE.

5   COPY SIMPLED.

        GOBACK.

6   DO-SIMPLE-SIMPLEOBJECT-CALL-ME.
        CALL "COAGET"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
        SET WS-COAGET TO TRUE.
        PERFORM CHECK-STATUS.

        CALL "COAPUT"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
        SET WS-COAPUT TO TRUE.
        PERFORM CHECK-STATUS.
```

Example 8: *The CICS SIMPLES Demonstration (Sheet 3 of 3)*

```
****************************************************************
* Check Errors Copybook
****************************************************************
7 COPY CERRSMFA.
```

Explanation of the CICS SIMPLES module

The CICS `SIMPLES` module can be explained as follows:

1. The `DISPATCH` logic is automatically coded for you, and the bulk of the code is contained in the `SIMPLED` copybook. When an incoming request arrives from the network, it is processed by the ORB and a call is made to the `DISPATCH` entry point.
2. `COAREQ` is called to provide information about the current invocation request, which is held in the `REQUEST-INFO` block that is contained in the `CORBA` copybook.

   `COAREQ` is called once for each operation invocation—after a request has been dispatched to the server, but before any calls are made to access the parameter values.
3. `STRGET` is called to copy the characters in the unbounded string pointer for the interface name to the string item representing the fully scoped interface name.
4. `STRGET` is called again to copy the characters in the unbounded string pointer for the operation name to the string item representing the operation name.
5. The procedural code used to perform the correct paragraph for the requested operation is copied into the module from the `SIMPLED` copybook.
6. Each operation has skeleton code, with appropriate calls to `COAPUT` and `COAGET` to copy values to and from the COBOL structures for that operation's argument list. You must provide a correct implementation for each operation. You must call `COAGET` and `COAPUT`, even if your operation takes no parameters and returns no data. You can simply pass in a dummy area as the parameter list.

7. The CICS server implementation uses a `COPY CERRSMFA` statement instead of `COPY CHKERRS`.

Note: The supplied `SIMPLES` module is only a suggested way of implementing an interface. It is not necessary to have all operations implemented in the same COBOL module.

Location of the CICS SIMPLES module

You can find a complete version of the CICS `SIMPLES` server implementation module in *`orbixhlq`*`.DEMO.CICS.CBL.SRC(SIMPLES)`.

Writing the Server Mainline

The server mainline module

The next step is to write the server mainline module in which to run the server implementation. For the purposes of this example, when you specify the `-S` and `-TCICS` arguments with the Orbix IDL compiler, it generates a module called `SIMPLESV`, which contains the server mainline code.

> **Note:** Unlike the batch server mainline, the CICS server mainline does not have to create and store stringified object references (IORs) for the interfaces that it implements, because this is handled by the CICS server adapter.

Example of the CICS SIMPLESV module

The following is an example of the CICS `SIMPLESV` module:

Example 9: *The CICS SIMPLESV Demonstration (Sheet 1 of 3)*

```
IDENTIFICATION DIVISION.
PROGRAM-ID.           SIMPLESV.
ENVIRONMENT DIVISION.
DATA DIVISION.

WORKING-STORAGE SECTION.

COPY SIMPLE.
COPY CORBA.

01 ARG-LIST                               PICTURE X(01)
                                          VALUE SPACES.
01 ARG-LIST-LEN                           PICTURE 9(09) BINARY
                                          VALUE 0.
01 ORB-NAME                               PICTURE X(10)
                                          VALUE "simple_orb".
01 ORB-NAME-LEN                           PICTURE 9(09) BINARY
                                          VALUE 10.

01 SERVER-NAME                            PICTURE X(07)
                                          VALUE "simple ".
01 SERVER-NAME-LEN                        PICTURE 9(09) BINARY
                                          VALUE 6.
```

Example 9: *The CICS SIMPLESV Demonstration (Sheet 2 of 3)*

```
01 INTERFACE-LIST.
   03 FILLER                              PICTURE X(28)
       VALUE "IDL:Simple/SimpleObject:1.0 ".
01 INTERFACE-NAMES-ARRAY REDEFINES INTERFACE-LIST.
   03 INTERFACE-NAME OCCURS 1 TIMES       PICTURE X(28).

01 OBJECT-ID-LIST.
   03 FILLER                              PICTURE X(27)
       VALUE "Simple/SimpleObject_object ".
01 OBJECT-ID-ARRAY REDEFINES OBJECT-ID-LIST.
   03 OBJECT-IDENTIFIER OCCURS 1 TIMES    PICTURE X(27).


****************************************************************
* Object values for the Interface(s)
****************************************************************
01 SIMPLE-SIMPLEOBJECT-OBJ               POINTER
                                         VALUE NULL.

PROCEDURE DIVISION.

INIT.

1       CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.
        SET WS-ORBSTAT TO TRUE.
        PERFORM CHECK-STATUS.

2       CALL "ORBARGS"   USING ARG-LIST
                               ARG-LIST-LEN
                               ORB-NAME
                               ORB-NAME-LEN.
        SET WS-ORBARGS TO TRUE.
        PERFORM CHECK-STATUS.

3       CALL "ORBSRVR"   USING SERVER-NAME
                               SERVER-NAME-LEN.
        SET WS-ORBSRVR TO TRUE.
        PERFORM CHECK-STATUS.

****************************************************************
* Interface Section Block
****************************************************************

*  Generating Object Reference for interface Simple/SimpleObject
```

Example 9: *The CICS SIMPLESV Demonstration (Sheet 3 of 3)*

```
4        CALL "ORBREG"  USING SIMPLE-SIMPLEOBJECT-INTERFACE.
         SET WS-ORBREG TO TRUE.
         PERFORM CHECK-STATUS.

5        CALL "OBJNEW"  USING SERVER-NAME
                              INTERFACE-NAME OF INTERFACE-NAMES-ARRAY(1)
                                OBJECT-IDENTIFIER OF OBJECT-ID-ARRAY(1)
                                SIMPLE-SIMPLEOBJECT-OBJ.
         SET WS-OBJNEW TO TRUE.
         PERFORM CHECK-STATUS.

6        CALL "COARUN".
         SET WS-COARUN TO TRUE.
         PERFORM CHECK-STATUS.

7        CALL "OBJREL"   USING SIMPLE-SIMPLEOBJECT-OBJ.
         SET WS-OBJREL TO TRUE.
         PERFORM CHECK-STATUS.

     EXIT-PRG.
         GOBACK.


     ****************************************************************
     * Check Errors Copybook
     ****************************************************************
     COPY CERRSMFA.
```

Explanation of the CICS SIMPLESV module

The CICS `SIMPLESV` module can be explained as follows:

1. `ORBSTAT` is called to register the `ORBIX-STATUS-INFORMATION` block that is contained in the `CORBA` copybook. Registering the `ORBIX-STATUS-INFORMATION` block allows the COBOL runtime to populate it with exception information, if necessary.
2. `ORBARGS` is called to initialize a connection to the ORB.
3. `ORBSRVR` is called to set the server name.
4. `ORBREG` is called to register the IDL interface, `SimpleObject`, with the Orbix COBOL runtime.
5. `OBJNEW` is called to create a persistent server object of the `SimpleObject` type, with an object ID of `my_simple_object`.

6. `COARUN` is called, to enter the `ORB::run` loop, to allow the ORB to receive and process client requests. This then processes the CORBA request that the CICS server adapter sends to CICS.
7. `OBJREL` is called to ensure that the servant object is released properly.

Location of the CICS SIMPLESV module

You can find a complete version of the CICS `SIMPLESV` server mainline module in *`orbixhlq`*`.DEMO.CICS.CBL.SRC(SIMPLESV)` after you have run *`orbixhlq`*`.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL)` to run the Orbix IDL compiler.

Building the Server

Location of the JCL

Sample JCL used to compile and link the CICS server mainline and server implementation is in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLESB).

When using a COBOL compiler later than 4.2, use this sample JCL:

orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB(SIMPBDSB)

Resulting load module

When this JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.CICS.CBL.LOADLIB(SIMPLESV).

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

orbixhlq.DEMO.CICS.CBL.BD.LOADLIB(SIMPLESV)

Preparing the Server to Run in CICS

Overview

This section describes the required steps to allow the server to run in a CICS region. These steps assume you want to run the CICS server against a batch client. When all the steps in this section have been completed, the server is started automatically within CICS, as required.

Steps

The steps to enable the server to run in a CICS region are:

Step	Action
1	Define an APPC transaction definition or EXCI program definition for CICS.
2	Provide the CICS server load module to a CICS region.
3	Generate mapping member entries for the CICS server adapter.
4	Add the interface's operation signatures to the type information repository, stored in the `TYPEINFO` PDS.
5	Obtain the IOR for use by the client program.

Step 1—Defining program or transaction definition for CICS

A CICS APPC transaction definition, or CICS EXCI program definition, must be created for the server, to allow it to run in CICS. The following is the CICS APPC transaction definition for the supplied demonstration:

```
DEFINE  TRANSACTION(SMSV)
        GROUP(ORXAPPC)
        DESCRIPTION(Orbix APPC Simple demo transaction)
        PROGRAM(SIMPLESV)
        PROFILE(DFHCICSA)
        TRANCLASS(DFHTCL00)
        DTIMOUT(10)
        SPURGE(YES)
        TPURGE(YES)
        RESSEC(YES)
```

The following is the CICS EXCI program definition for the supplied demonstration:

```
DEFINE  PROGRAM(SIMPLESV)
        GROUP(ORXDEMO)
        DESCRIPTION(Orbix Simple demo server)
        LANGUAGE(LE370)
        DATALOCATION(ANY)
        EXECUTIONSET(DPLSUBSET)
```

See the supplied *orbixhlq*.JCLLIB(ORBIXCSD) for a more detailed example of how to define the resources that are required to use Orbix with CICS and to run the supplied demonstrations.

Step 2—Providing load module to CICS region

Ensure that the *orbixhlq*.DEMO.CICS.CBL.LOADLIB PDS is added to the DFHRPL for the CICS region that is to run the transaction, or copy the SIMPLESV load module to a PDS in the DFHRPL of the relevant CICS region.

When using a COBOL compiler later than version 4.2, use this PDSE:

orbixhlq.DEMO.CICS.CBL.BD.LOADLIB

Step 3—Generating mapping member entries

The CICS server adapter requires mapping member entries, so that it knows which CICS APPC transaction or CICS EXCI program should be run for a particular interface and operation. The mapping member entry for the supplied CICS EXCI server example is contained by default in *orbixhlq*.DEMO.CICS.MFAMAP(SIMPLEA) after you run the IDL compiler. The mapping member entry for EXCI appears as follows:

```
(Simple/SimpleObject,call_me,SIMPLESV)
```

Note: If instead you chose to enable the line in SIMPLIDL to generate a mapping member entry for a CICS APPC version of the demonstration, that mapping member entry would appear as follows:

```
(Simple/SimpleObject,call_me,SMSV)
```

The generation of a mapping member for the CICS server adapter is performed by the *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL) JCL. The -mfa:-t*tran_or_program_name* argument with the IDL compiler generates the mapping member. For the purposes of this example, *tran_or_program_name* is replaced with SIMPLESV. An IDLMFA DD statement must also be provided in the JCL, to specify the PDS into which the mapping member is generated. See the *CICS Adapters Administrator's Guide* for full details about CICS adapter mapping members.

Step 4—Adding operation signatures to type_info store

The CICS server adapter needs to be able to obtain operation signatures for the COBOL server. For the purposes of this demonstration, the `TYPEINFO` PDS is used to store this type information. This type information is necessary so that the adapter knows what data types it has to marshal into IMS for the server, and what data types it can expect back from the IMS transaction. This information is generated by supplying the `-mfa:-inf` option to the Orbix IDL compiler, for example, as used in the `SIMPLIDL` JCL that is used to generate the source code and copybooks for this demonstration.

> **Note:** An IDL interface only needs to be added to the type information store once.

> **Note:** An alternative to using type information files is to use the Interface Repository (IFR). This is an alternative method of allowing the CICS server adapter to retrieve IDL type information. If you are using the IFR, you must ensure that the relevant IDL for the server has been added to the IFR (that is, registered with it) before the CICS server adapter is started.
>
> To add IDL to the IFR, first ensure the IFR is running. You can use the JCL in *`orbixhlq`*`.JCLLIB(IFR)` to start it. Then, in the JCL that you use to run the Orbix IDL compiler, add the line `// IDLPARM='-R'` to register the IDL. In this case, ensure that all other `// IDLPARM` lines are commented out as follows: `//*   IDLPARM...`

Step 5—Obtaining the server adapter IOR

The final step is to obtain the IOR that the batch client needs to locate the CICS server adapter. Before you do this, ensure all of the following:

- The type_info store contains the relevant operation signatures (or, if using the IFR, the IFR is running and contains the relevant IDL). See "Step 4—Adding operation signatures to type_info store" on page 157 for details of how to populate the type_info store.

- The CICS server adapter mapping member contains the relevant mapping entries. For the purposes of this example, ensure that the `orbixhlq.DEMO.CICS.MFAMAP(SIMPLEA)` mapping member is being used. See the *CICS Adapters Administrator's Guide* for details about CICS server adapter mapping members.
- The CICS server adapter is running. The supplied JCL in `orbixhlq.JCLLIB(CICSA)` starts the CICS server adapter. See the *CICS Adapters Administrator's Guide* for more details.

Now submit `orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIOR)`, to obtain the IOR that the batch client needs to locate the CICS server adapter. This JCL includes the `resolve` command, to obtain the IOR. The following is an example of the `SIMPLIOR` JCL:

```
//         JCLLIB ORDER=(orbixhlq.PROCLIB)
//         INCLUDE MEMBER=(ORXVARS)
//*
//* Request the IOR for the CICS 'simple_persistent' server
//* and store it in a PDS for use by the client.
//*
//* Make the following changes before running this JCL:
//*
//* 1.   Change 'SET DOMAIN='DEFAULT@' to your configuration
//*      domain name.
//*
//            SET DOMAIN='DEFAULT@'
//*
//REG      EXEC PROC=ORXADMIN,
//  PPARM='mfa resolve Simple/SimpleObject > DD:IOR'
//IOR DD DSN=&ORBIX..DEMO.IORS(SIMPLE),DISP=SHR
//ORBARGS  DD *
-ORBname iona_utilities.cicsa
/*
//ITDOMAIN DD DSN=&ORBIXCFG(&DOMAIN),DISP=SHR
```

Developing the CICS Client

Overview

This section describes the steps you must follow to develop the CICS client executable for your application. The CICS client developed in this example will connect to the simple batch server demonstration.

Note: The Orbix IDL compiler does not generate COBOL client stub code.

Steps to develop the client

The steps to develop and run the client application are:

Step	Action
1	"Writing the Client" on page 160.
2	"Building the Client" on page 165.
3	"Preparing the Client to Run in CICS" on page 166.

Writing the Client

The client program

The next step is to write the client program, to implement the CICS client. This example uses the supplied `SIMPLECL` client demonstration.

Example of the SIMPLECL module

The following is an example of the CICS `SIMPLECL` module:

Example 10: *The CICS SIMPLECL Demonstration (Sheet 1 of 3)*

```
**************************************************************
*
* (C) Copyright 1997-2021 Micro Focus or one of its affiliates.
*
* The only warranties for products and services of
* Micro Focus and its affiliates and licensors
* ("Micro Focus") are as may be set forth in the express
* warranty statements accompanying such products and
* services. Nothing herein should be construed as
* constituting an additional warranty. Micro Focus shall not
* be liable for technical or editorial errors or omissions
* contained herein. The information contained herein is
* subject to change without notice.
*
* Except as specifically indicated otherwise, this document
* contains confidential information and a valid license is
* required for possession, use or copying. If this work is
* provided to the U.S. Government, consistent with FAR
* 12.211 and 12.212, Commercial Computer Software, Computer
* Software Documentation, and Technical Data for Commercial
* Items are licensed to the U.S. Government under vendor's
* standard commercial license.
*
**************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.                    SIMPLECL.

 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 INPUT-OUTPUT SECTION.
 DATA DIVISION.

 WORKING-STORAGE SECTION.
```

Example 10: *The CICS SIMPLECL Demonstration (Sheet 2 of 3)*

```
   COPY SIMPLE.
   COPY CORBA.
   COPY WSCICSCL.

1  01 WS-SIMPLE-URL                  PICTURE X(27) VALUE
       "corbaloc:rir:/SimpleObject ".
   01 WS-SIMPLE-URL-LENGTH           PICTURE 9(9) BINARY
                                     VALUE 27.
   01 WS-SIMPLE-URL-PTR              POINTER
                                     VALUE NULL.
   01 SIMPLE-SIMPLEOBJECT-OBJ        POINTER
                                     VALUE NULL.
   01 ARG-LIST                       PICTURE X(80)
                                     VALUE SPACES.
   01 ARG-LIST-LEN                   PICTURE 9(09) BINARY
                                     VALUE 0.
   01 ORB-NAME                       PICTURE X(10)
                                     VALUE "simple_orb".
   01 ORB-NAME-LEN                   PICTURE 9(09) BINARY
                                       VALUE 10.
   PROCEDURE DIVISION.
   0000-MAINLINE.
2      CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.

  *  ORB initialization
       DISPLAY "Initializing the ORB".
3      CALL "ORBARGS"   USING ARG-LIST
                              ARG-LIST-LEN
                              ORB-NAME
                              ORB-NAME-LEN.
       SET WS-ORBARGS TO TRUE.
       PERFORM CHECK-STATUS.

  * Register interface SimpleObject
       DISPLAY "Registering the Interface".
4      CALL  "ORBREG"   USING SIMPLE-SIMPLEOBJECT-INTERFACE.
       SET WS-ORBREG TO TRUE.
       PERFORM CHECK-STATUS.

  * Set the COBOL pointer to point to the URL string
5      CALL "STRSET"    USING WS-SIMPLE-URL-PTR
                              WS-SIMPLE-URL-LENGTH
                              WS-SIMPLE-URL.
       SET WS-STRSET TO TRUE.
       PERFORM CHECK-STATUS.
```

Example 10: *The CICS SIMPLECL Demonstration (Sheet 3 of 3)*

```
   * Obtain object reference from the url
6       CALL "STRTOOBJ"  USING WS-SIMPLE-URL-PTR
                               SIMPLE-SIMPLEOBJECT-OBJ.

        SET WS-STRTOOBJ TO TRUE.
        PERFORM CHECK-STATUS.
   * Releasing the memory
        CALL "STRFREE"   USING WS-SIMPLE-URL-PTR.
        SET WS-STRFREE TO TRUE.
        PERFORM CHECK-STATUS.

        SET SIMPLE-SIMPLEOBJECT-CALL-ME    TO TRUE
        DISPLAY "invoking Simple::" SIMPLE-SIMPLEOBJECT-OPERATION.


7       CALL "ORBEXEC"   USING SIMPLE-SIMPLEOBJECT-OBJ
                               SIMPLE-SIMPLEOBJECT-OPERATION
                               SIMPLE-SIMPLEOBJECT-DCD9-ARGS
                               SIMPLE-USER-EXCEPTIONS.
        SET WS-ORBEXEC TO TRUE.
        PERFORM CHECK-STATUS

8       CALL "OBJREL" USING SIMPLE-SIMPLEOBJECT-OBJ.
        SET WS-OBJREL TO TRUE.
        PERFORM CHECK-STATUS.

        DISPLAY "Simple demo complete.".
        MOVE SPACES TO WS-CICS-MESSAGE.
        MOVE "Simple Transaction completed" to WS-CICS-MESSAGE.
9       PERFORM EXEC-SEND-TEXT THRU EXEC-SEND-TEXT-END.

    EXIT-PRG.
   *=========.
        EXEC CICS RETURN END-EXEC.

   ****************************************************************
   * Output CICS Message
   ****************************************************************
10  COPY CICWRITE.
   ****************************************************************
   * Check Errors Copybook
   ****************************************************************
11  COPY CHKCLCIC.
```

Explanation of the SIMPLECL module

The CICS `SIMPLECL` module can be explained as follows:

1. `WS-SIMPLE-URL` defines a corbaloc URL string in the `corbaloc:rir` format. This string identifies the server with which the client is to communicate. This string can be passed as a parameter to `STRTOOBJ`, to allow the client to retrieve an object reference to the server. See point **6** about `STRTOOBJ` for more details.
2. `ORBSTAT` is called to register the `ORBIX-STATUS-INFORMATION` block that is contained in the `CORBA` copybook. Registering the `ORBIX-STATUS-INFORMATION` block allows the COBOL runtime to populate it with exception information, if necessary.

   You can use the `ORBIX-STATUS-INFORMATION` data item (in the `CORBA` copybook) to check the status of any Orbix call. The `EXCEPTION-NUMBER` numeric data item is important in this case. If this item is `0`, it means the call was successful. Otherwise, `EXCEPTION-NUMBER` holds the system exception number that occurred. You should test this data item after any Orbix call.
3. `ORBARGS` is called to initialize a connection to the ORB.
4. `ORBREG` is called to register the IDL interface with the Orbix COBOL runtime.
5. `STRSET` is called to create an unbounded string to which the stringified object reference is copied.
6. `STRTOOBJ` is called to create an object reference to the server object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string in the form `corbaloc:rir:/SimpleObject` (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.
7. After the object reference is created, `ORBEXEC` is called to invoke operations on the server object represented by that object reference. You must pass the object reference, the operation name, the argument description packet, and the user exception buffer. The operation name must be terminated with a space. The same argument description is

used by the server. For ease of use, string identifiers for operations are defined in the `SIMPLE` copybook. For example, see *orbixhlq*.DEMO.CICS.CBL.COPYLIB(SIMPLE).

8. `OBJREL` is called to ensure that the servant object is released properly.
9. The `EXEC-SEND-TEXT` paragraph is copied in from the `CICWRITE` copybook and is used to write messages to the CICS terminal. The client uses this to indicate whether the call was successful or not.
10. A paragraph that writes messages generated by the demonstrations to the CICS terminal is copied in from the `CICWRITE` copybook.
11. The CICS-translated version of the error-checking routine for system exceptions generated by the demonstrations is copied in from the `CHKCLCIC` copybook.

Location of the SIMPLECL module

You can find a complete version of the CICS `SIMPLECL` client module in *orbixhlq*.DEMO.CICS.CBL.SRC(SIMPLECL).

Building the Client

JCL to build the client

Sample JCL used to compile and link the client can be found in the third step of *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLECB).

When using a COBOL compiler later than version 4.2, use this sample JCL:

orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB(SIMPBDCB)

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.CICS.CBL.LOADLIB(SIMPLECL).

When using a COBOL compiler later than 4.2, the resulting load module goes into this PDSE:

orbixhlq.DEMO.CICS.CBL.BD.LOADLIB(SIMPLECL)

Preparing the Client to Run in CICS

Overview

This section describes the required steps to allow the client to run in a CICS region. These steps assume you want to run the CICS client against a batch server.

Steps

The steps to enable the client to run in a CICS region are:

Step	Action
1	Define an APPC transaction definition for CICS.
2	Provide the CICS client load module to a CICS region.
3	Start the locator and node daemon on the server host.
4	Add the interface's operation signatures to the type information repository.
5	Start the batch server.
6	Customize the batch server IOR.
7	Configure and run the client adapter.

Step 1—Define transaction definition for CICS

A CICS APPC transaction definition must be created for the client, to allow it to run in CICS. The following is the CICS APPC transaction definition for the supplied demonstration:

```
DEFINE  TRANSACTION(SMCL)
        GROUP(ORXDEMO)
        DESCRIPTION(Orbix Client Simple demo transaction)
        PROGRAM(SIMPLECL)
        PROFILE(DFHCICSA)
        TRANCLASS(DFHTCL00)
        DTIMOUT(10)
        SPURGE(YES)
        TPURGE(YES)
        RESSEC(YES)
```

See the supplied *orbixhlq*.JCLLIB(ORBIXCSD) for a more detailed example of how to define the resources that are required to use Orbix with CICS and to run the supplied demonstrations.

Step 2—Provide client load module to CICS region

Ensure that the *orbixhlq*.DEMO.CICS.CBL.LOADLIB PDS is added to the DFHRPL for the CICS region that is to run the transaction.

Note: If you have already done this for your CICS server load module, you do not need to do this again.

Alternatively, you can copy the SIMPLECL load module to a PDS in the DFHRPL of the relevant CICS region.

When using a COBOL compiler later than version 4.2, use this PDSE:

orbixhlq.DEMO.CICS.CBL.BD.LOADLIB

Step 3—Start locator and node daemon on server host

This step assumes that you intend running the CICS client against the supplied batch demonstration server.

In this case, you must start all of the following on the batch server host (if they have not already been started):

1. Start the locator daemon by submitting *orbixhlq*.JCLLIB(LOCATOR).
2. Start the node daemon by submitting *orbixhlq*.JCLLIB(NODEDAEM).

See "Running the Server and Client" on page 45 for more details of running the locator and node daemon on the batch server host.

Step 4—Add operation signatures to type_info store

The client adapter needs to be able to know what data types it can expect to marshal from the CICS APPC transaction, and what data types it should expect back from the batch server. This can be done by creating a type information file by running the Orbix IDL compiler with the -mfa:-inf flag, which is included in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(SIMPLIDL). The type information file contains descriptions of the interface's operation signatures (that is, information about the type and direction of the operation parameters, the number of parameters, and whether or not an operation has a return type).

Before the client adapter is run, the `TYPEINFO` DD card needs to be updated to the location of the `TYPEINFO` PDS (for the purposes of this example, to *orbixhlq*.DEMO.TYPEINFO).

Note: An IDL interface only needs to be added to the type information store once.

Note: An alternative to using type information files is to use the Interface Repository (IFR). This is an alternative method of allowing the client adapter to obtain information about relevant data types. If you are using the IFR, you must ensure that the relevant IDL for the server has been added to the IFR (that is, registered with it) before the client adapter is started.

To add IDL to the IFR, first ensure the IFR is running. You can use the JCL in *orbixhlq*.JCLLIB(IFR) to start it. Then, in the JCL that you use to run the Orbix IDL compiler, add the line `// IDLPARM='-R'` to register the IDL. In this case, ensure that all other `// IDLPARM` lines are commented out as follows: `//*  IDLPARM...`

Step 5—Start batch server

This step assumes that you intend running the CICS client against the demonstration batch server.

Submit the following JCL to start the batch server:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPLESV)
```

See “Running the Server and Client” on page 45 for more details of running the locator and node daemon on the batch server host.

When using a COBOL compiler later than version 4.2, use:

```
orbixhlq.DEMO.CBL.RUN.JCLLIB(SIMPBDSV)
```

Step 6—Customize batch server IOR

When you run the batch server it publishes its IOR to a member called *orbixhlq*.DEMO.IORS(SIMPLE). The CICS client needs to use this IOR to contact the server.

The demonstration CICS client obtains the object reference for the demonstration batch server in the form of a corbaloc URL string. A corbaloc URL string can take different formats. For the purposes of this demonstration, it takes the form `corbaloc:rir:/SimpleObject`. This form of the corbaloc URL string requires the use of a configuration variable, `initial_references:SimpleObject:reference`, in the configuration domain. When you submit the JCL in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(UPDTCONF), it automatically adds this configuration entry to the configuration domain:

```
initial_references:SimpleObject:reference = "IOR…";
```

The IOR value is taken from the *orbixhlq*.DEMO.IORS(SIMPLE) member.

See “STRTOOBJ” on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

Step 7—Configure and run client adapter

The client adapter must now be configured before you can start the client (the CICS transaction). See the *CICS Adapters Administrator’s Guide* for details of how to configure the client adapter.

When you have configured the client adapter, you can run it by submitting *orbixhlq*.JCLLIB(CICSCA).

Note: See “Running the Demonstrations” on page 191 for details of how to run the sample demonstration.

Developing the CICS Two-Phase Commit Client

Overview

This section describes the steps you must follow to develop the CICS two-phase commit client executable for your application. The CICS two-phase commit client developed in this example will connect to two demonstration C++ batch servers.

Note: The APPC transport must be configured for two-phase commit support. The cross memory communication transport does not support two-phase commit.

Steps to develop the client

The steps to develop and run the client application are:

Step	Action
1	"Writing the Client" on page 171.
2	"Building the Client" on page 186.
3	"Building the Servers" on page 187.
4	"Preparing the Client to Run in CICS" on page 188.

Writing the Client

The client program

The next step is to write the CICS client transaction. This example uses the supplied `DATACL` client demonstration.

CICS transaction design

A CICS transaction that uses two-phase commit can be broken down as follows:

- Operations that do not require two-phase commit.
- Operations that require two-phase commit.

Read-only operations to local databases or remote servers do not require two-phase commit processing. These operations should be performed first in the CICS transaction ahead of the two-phase commit operations. The rationale behind this is that if operations not requiring two-phase commit processing fail, it might be pointless to perform operations that do require two-phase commit processing.

Overview of CICS transaction layout

Figure 5 provides an overview of CICS transaction layout.

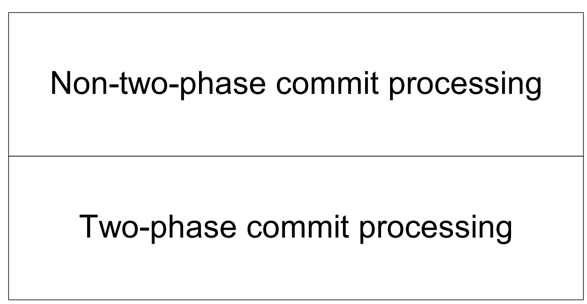

Figure 5: *Overview of CICS Transaction Layout*

Designing a CICS two-phase commit transaction

When designing a CICS two-phase commit transaction, structure the transaction as follows:

1. Begin the CICS transaction by performing standard Orbix Mainframe CICS client initialization.
2. Perform operations that do not require two-phase commit. If any of the operations fail, skip the two-phase commit processing.
3. Call `ORBTXNB` to indicate the start of two-phase commit processing.
4. Call `ORBEXEC` (perhaps multiple times) to send an update to a remote server. If any of the calls fail, call rollback and skip any updates to local resources.
5. Make updates to local resources, such as updating a local database. If any of the local updates fail, call rollback.
6. Call `ORBTXNE` to indicate the end of the two-phase commit work.
7. Call `SYNCPOINT` to initiate two-phase commit processing.
8. Perform any post two-phase commit work, such as sending a message back to the user.

Commit or rollback scenarios

When a CICS transaction makes updates to resources (that is, local databases or remote CORBA servers) via the client adapter, the updates are not made permanent until the two-phase commit has been successfully processed. The trigger for starting the two-phase commit is when the CICS transaction calls `SYNCPOINT`.

The client adapter sends a "prepare" message to each remote server that has been updated from the CICS transaction. Each server returns a vote to the client adapter. A vote of "commit" indicates the remote server is willing to commit its updates. A vote of "rollback" indicates the remote server has a problem and that it wants to roll back the update.

The various scenarios that might arise are as follows:

- Successful two-phase commit

  If all returned votes are "commit", the client adapter calls the IBM API `SRRCMIT`, to inform CICS that all remote servers are willing to commit their updates. If the return code from `SRRCMIT` is `0`, the client adapter sends a "commit" message to each remote server. Two-phase commit processing is then completed and all resources are updated.

- Rollback two-phase commit—Scenario 1

  If the client adapter receives at least one returned vote of "rollback", all updates should be rolled back. The client adapter calls the IBM API `SRRBACK`, to inform CICS that there are problems. This causes the `SYNCPOINT` call issued in the CICS transaction to complete with a `ROLLEDBACK` code.
- Rollback two-phase commit—Scenario 2

  If all returned votes are "commit", the client adapter calls the IBM API `SRRCMIT`, to inform CICS that all remote servers are willing to commit their updates. If the return code from `SRRCMIT` is not `0`, the client adapter sends a "rollback" message to each server. In this case, this means that a resource other than the remote servers has voted "rollback".
- Rollback two-phase commit—Scenario 3

  If the CICS transaction makes an update to a remote server, and the update fails (because, for example, the server is not running), the transaction calls "rollback" to undo any updates. The client adapter receives the rollback signal and sends a "rollback" message to each server.

Example of the DATACL module

The following is an example of the CICS `DATACL` module:

Example 11: *The CICS DATACL Demonstration (Sheet 1 of 10)*

```
**************************************************************
*
* (C) Copyright 1997-2021 Micro Focus or one of its affiliates.
*
* The only warranties for products and services of
* Micro Focus and its affiliates and licensors
* ("Micro Focus") are as may be set forth in the express
* warranty statements accompanying such products and
* services. Nothing herein should be construed as
* constituting an additional warranty. Micro Focus shall not
* be liable for technical or editorial errors or omissions
* contained herein. The information contained herein is
* subject to change without notice.
*
* Except as specifically indicated otherwise, this document
```

Example 11: *The CICS DATACL Demonstration (Sheet 2 of 10)*

```
* contains confidential information and a valid license is
* required for possession, use or copying. If this work is
* provided to the U.S. Government, consistent with FAR
* 12.211 and 12.212, Commercial Computer Software, Computer
* Software Documentation, and Technical Data for Commercial
* Items are licensed to the U.S. Government under vendor's
* standard commercial license.
*
***************************************************************
*
* Description: This is a CICS COBOL client that sends update
*              requests to remote servers, then commits the
*              updates using the two-phase commit protocol.
*
*****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID.                    DATACL.

 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 INPUT-OUTPUT SECTION.
 DATA DIVISION.

 WORKING-STORAGE SECTION.

 COPY DATA.
 COPY CORBA.
 COPY WSCICSCL.

1 01 WS-DATA-URLA                  PICTURE X(26) VALUE
     "corbaloc:rir:/DataObjectA ".
1 01 WS-DATA-URLB                  PICTURE X(26) BINARY
     "corbaloc:rir:/DataObjectB ".
 01 WS-DATA-URLA-LENGTH           PICTURE 9(9) BINARY
                                  VALUE 26.
 01 WS-DATA-URLB-LENGTH           PICTURE 9(9) BINARY
                                  VALUE 26.
 01 WS-DATA-URL-PTR               POINTER
                                  VALUE NULL.
 01 DATA-OBJA                     POINTER
                                  VALUE NULL.
 01 DATA-OBJB                     POINTER
                                  VALUE NULL.
 01 ARG-LIST                      PICTURE X(80)
                                  VALUE SPACES.
```

Example 11: *The CICS DATACL Demonstration (Sheet 3 of 10)*

```
 01 ARG-LIST-LEN                    PICTURE 9(09) BINARY
                                    VALUE 0.
 01 ORB-NAME                        PICTURE X(10)
                                    VALUE "twopc_orb".
 01 ORB-NAME-LEN                    PICTURE 9(09) BINARY
                                    VALUE 10.

 01 RESULTS-AREA.
    03 READ-RESULT-A                PICTURE 9
                                    VALUE 0.
    03 UPDATE-RESULT-A              PICTURE 9
                                    VALUE 0.
    03 READ-RESULT-B                PICTURE 9
                                    VALUE 0.
    03 UPDATE-RESULT-B              PICTURE 9
                                    VALUE 0.

 01 RESP-VALUES.
    03 RESP1                        PICTURE 9(09) BINARY.
    03 RESP2                        PICTURE 9(09) BINARY.

 PROCEDURE DIVISION.
****************************************************************
* 0000-MAINLINE.
*
2 * Process a two-phase commit transaction. The general flow of
* the transaction is as follows:
*
*   begin a transaction (ORBTXNB)
*     read a value from "server A" (ORBEXEC)
*     send an update to "server A" (ORBEXEC)
*     read a value from "server B" (ORBEXEC)
*     send an update to "server B" (ORBEXEC)
*     if all requests were successful, commit them (SYNCPOINT)
*     otherwise roll them back (ROLLBACK)
*   end the transaction (ORBTXNE)
*
****************************************************************
 0000-MAINLINE.

     PERFORM 1000-INITIALIZE.
     PERFORM 2000-PROCESS-TRANSACTION.
     PERFORM 3000-TERMINATE.

     EXEC CICS RETURN END-EXEC.
```

Example 11: *The CICS DATACL Demonstration (Sheet 4 of 10)*

```
****************************************************************
* 1000-INITIALIZE
*
* Get references to "server A" and "server B".
*
****************************************************************
1000-INITIALIZE.

2    CALL "ORBSTAT"   USING ORBIX-STATUS-INFORMATION.

*  ORB initialization
     DISPLAY "Initializing the ORB".
3    CALL "ORBARGS"   USING ARG-LIST
                            ARG-LIST-LEN
                            ORB-NAME
                            ORB-NAME-LEN.
     SET WS-ORBARGS TO TRUE.
     PERFORM CHECK-STATUS.

*  Register interface Twopc
     DISPLAY "Registering the Interface".
4    CALL "ORBREG"   USING DATA-INTERFACE-INTERFACE.
     SET WS-ORBREG TO TRUE.
     PERFORM CHECK-STATUS.

* Set the COBOL pointer to point to the URLA string
5    CALL  "STRSET"   USING WS-DATA-URL-PTR
                            WS-DATA-URLA-LENGTH
                            WS-DATA-URLA.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

* Obtain object A reference from the url
6    CALL "STRTOOBJ"  USING WS-DATA-URL-PTR
                            DATA-OBJA.
     SET WS-STRTOOBJ TO TRUE.
     PERFORM CHECK-STATUS.

* Releasing the memory
     CALL "STRFREE"   USING WS-DATA-URL-PTR.
     SET WS-STRFREE TO TRUE.
     PERFORM CHECK-STATUS.

* Set the COBOL pointer to point to the URLB string
```

Example 11: *The CICS DATACL Demonstration (Sheet 5 of 10)*

```
7        CALL  "STRSET"   USING WS-DATA-URL-PTR
                                WS-DATA-URLB-LENGTH
                                WS-DATA-URLB.
         SET WS-STRSET TO TRUE.
         PERFORM CHECK-STATUS.

     * Obtain object B reference from the url
8        CALL "STRTOOBJ"  USING WS-DATA-URL-PTR
                                DATA-OBJB.
         SET WS-STRTOOBJ TO TRUE.
         PERFORM CHECK-STATUS.

     * Releasing the memory
         CALL "STRFREE"   USING WS-DATA-URL-PTR.
         SET WS-STRFREE TO TRUE.
         PERFORM CHECK-STATUS.

     ****************************************************************
     * 2000-PROCESS-TRANSACTION
     *
     * Begin a two-phase commit transaction by calling ORBTXNB.
     * Read a value from "server A". Add 1 to the value and
     * update "server A" with the new value. Read a value from
     * "server B". Add 1 to the value and update "server B" with
     * the new value.
     *
     * Check that all requests were successful.
     * If so, request a commit by calling SYNCPOINT.
     * If not, back out the updates by calling ROLLBACK.
     *
     * End the two-phase commit transaction by calling ORBTXNE.
     *
     ****************************************************************
     2000-PROCESS-TRANSACTION.

     *  Begin a transaction.
9        CALL "ORBTXNB".
         SET WS-ORBTXNB TO TRUE.
         PERFORM CHECK-STATUS.
         DISPLAY "Two-phase commit transaction begins".

         PERFORM 2005-READ-VALUE-A.

         IF READ-RESULT-A IS EQUAL TO 1
            PERFORM 2010-UPDATE-VALUE-A.
```

Example 11: *The CICS DATACL Demonstration (Sheet 6 of 10)*

```
        IF UPDATE-RESULT-A IS EQUAL TO 1
           PERFORM 2015-READ-VALUE-B.

        IF READ-RESULT-B IS EQUAL TO 1
           PERFORM 2020-UPDATE-VALUE-B.

        IF READ-RESULT-A   IS EQUAL TO 1 AND
           UPDATE-RESULT-A IS EQUAL TO 1 AND
           READ-RESULT-B   IS EQUAL TO 1 AND
           UPDATE-RESULT-B IS EQUAL TO 1
           MOVE 42 TO OUT-LL OF OUTPUT-AREA
           MOVE "Two-phase commit transaction completed" TO
                 WS-CICS-MESSAGE
           DISPLAY "All updates successful -"
           DISPLAY "request commit"
           PERFORM 2060-SYNCPOINT
        ELSE
           MOVE "A problem was encountered - rolling back" TO
                WS-CICS-MESSAGE
           DISPLAY "Some updates were not successful -"
           DISPLAY "request rollback"
14         PERFORM 2070-ROLLBACK.

   *  End the transaction.
15      CALL "ORBTXNE".
        SET WS-ORBTXNE TO TRUE.
        PERFORM CHECK-STATUS.
        DISPLAY "Two-phase commit transaction ends".

        PERFORM EXEC-SEND-TEXT THRU EXEC-SEND-TEXT-END.

   ****************************************************************
   * 2005-READ-VALUE-A
   *
   * Read a value from "server A".
   *
   ****************************************************************
   2005-READ-VALUE-A.

        SET READ-OPERATION TO TRUE.
        DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

10      CALL "ORBEXEC"    USING DATA-OBJA
                                DATA-INTERFACE-OPERATION
```

Example 11: *The CICS DATACL Demonstration (Sheet 7 of 10)*

```
                              READ-OPERATION-ARGS
                              DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO READ-RESULT-A
        DISPLAY "Successfully read a value from server A:  "
                IDL-VALUE OF READ-OPERATION-ARGS.

****************************************************************
* 2010-UPDATE-VALUE-A
*
* Request that "server A" update a value.
*
****************************************************************
2010-UPDATE-VALUE-A.

     MOVE IDL-VALUE OF READ-OPERATION-ARGS
       TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     ADD 1 TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     DISPLAY "New value for server A:  " IDL-VALUE OF
             WRITE-OPERATION-ARGS.

     SET WRITE-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

11   CALL "ORBEXEC"    USING DATA-OBJA
                              DATA-INTERFACE-OPERATION
                              READ-OPERATION-ARGS
                              DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO UPDATE-RESULT-A
        DISPLAY "Server A has successfully updated the value".

****************************************************************
* 2015-READ-VALUE-B
*
* Read a value from "server B".
*
```

Example 11: *The CICS DATACL Demonstration (Sheet 8 of 10)*

```
****************************************************************
2015-READ-VALUE-B.

     SET READ-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

12   CALL "ORBEXEC"    USING DATA-OBJB
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.
     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO READ-RESULT-B
        DISPLAY "Successfully read a value from server B:  "
                IDL-VALUE OF READ-OPERATION-ARGS.

****************************************************************
* 2020-UPDATE-VALUE-B
*
* Request that "server B" update a value.
*
****************************************************************
2020-UPDATE-VALUE-B.

     MOVE IDL-VALUE OF READ-OPERATION-ARGS
       TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     ADD 1 TO IDL-VALUE OF WRITE-OPERATION-ARGS.
     DISPLAY "New value for server B:  " IDL-VALUE OF
             WRITE-OPERATION-ARGS.

     SET WRITE-OPERATION TO TRUE.
     DISPLAY "Invoking:  " DATA-INTERFACE-OPERATION.

13   CALL "ORBEXEC"    USING DATA-OBJB
                             DATA-INTERFACE-OPERATION
                             READ-OPERATION-ARGS
                             DATA-USER-EXCEPTIONS.

     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

     IF CORBA-NO-EXCEPTION
        MOVE 1 TO UPDATE-RESULT-B
```

Example 11: *The CICS DATACL Demonstration (Sheet 9 of 10)*

```
        DISPLAY "Server B has successfully updated the value".

****************************************************************
* 2060-SYNCPOINT.
*
* Issue a SYNCPOINT call.
*
****************************************************************
2060-SYNCPOINT.

     EXEC CICS SYNCPOINTIF CORBA-NO-EXCEPTION
        RESP(RESP1)
        RESP2(RESP2)
     END-EXEC.

     IF RESP1 = DFHRESP(ROLLEDBACK)
        DISPLAY 'Rollback requested by partner.'
        MOVE "Two-phase commit - partner requested a rollback"
        TO WS-CICS-MESSAGE
     ELSE IF RESP1 NOT EQUAL DFHRESP(NORMAL)
        DISPLAY 'Syncpoint has failed'.

****************************************************************
* 2070-ROLLBACK.
*
* Issue a ROLLBACK call.
*
****************************************************************
2070-ROLLBACK.

     EXEC CICS SYNCPOINT ROLLBACK END-EXEC.

****************************************************************
* 3000-TERMINATE
*
* Release the references to "server A" and "server B".
*
****************************************************************
3000-TERMINATE.

    CALL "OBJREL" USING DATA-OBJA.
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "OBJREL" USING DATA-OBJB.
```

Example 11: *The CICS DATACL Demonstration (Sheet 10 of 10)*

```
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.

****************************************************************
* Output CICS message.
****************************************************************
COPY CICWRITE.

****************************************************************
* CHECK-STATUS
****************************************************************
CHECK-STATUS.

     IF NOT CORBA-NO-EXCEPTION THEN
        DISPLAY "System Exception encountered"
        DISPLAY "Function called  : " WS-API-CALLED
        SET CORBA-EXCEPTION-INDEX TO CORBA-EXCEPTION
        SET C0RBA-EXCEPTION-INDEX UP BY 1
        DISPLAY "Exception name   : "
            CORBA-EXCEPTION-NAME(CORBA-EXCEPTION-INDEX)

        CALL "STRGET"  USING EXCEPTION-TEXT
                             ERROR-TEXT-LEN OF
                             ORBIX-EXCEPTION-TEXT
                             ERROR-TEXT OF
                             ORBIX-EXCEPTION-TEXT

        DISPLAY "Exception        : "
        DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (1:64)
        DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (64:64)
        DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (128:64)
        MOVE SPACES           TO WS-CICS-MESSAGE
        STRING  "Transaction failed in api:  "
                              DELIMITED BY SIZE
                WS-API-CALLED DELIMITED BY SIZE
                INTO WS-CICS-MESSAGE
        PERFORM EXEC-SEND-TEXT THRU EXEC-SEND-TEXT-END

     END-IF.
```

Explanation of the DATACL module

The CICS DATACL module can be explained as follows:

1. WS-DATA-URLA and WS-DATA-URLB define corbaloc URL strings in the corbaloc:rir format. These strings identify the servers with which the client is to communicate. The strings can be passed as a parameter to STRTOOBJ to allow the client to retrieve an object reference to the server. See point **6** about STRTOOBJ for more details.
2. ORBSTAT is called to register the ORBIX-STATUS-INFORMATION block that is contained in the CORBA copybook. Registering the ORBIX-STATUS-INFORMATION block allows the COBOL runtime to populate it with exception information, if necessary.

   You can use the ORBIX-STATUS-INFORMATION data item (in the CORBA copybook) to check the status of any Orbix call. The EXCEPTION-NUMBER numeric data item is important in this case. If this item is 0, it means the call was successful. Otherwise, EXCEPTION-NUMBER holds the system exception number that occurred. You should test this data item after any Orbix call.
3. ORBARGS is called to initialize a connection to the ORB.
4. ORBREG is called to register the IDL interface with the Orbix COBOL runtime.
5. STRSET is called to create an unbounded string to which the stringified object reference to server 'A' is copied.
6. STRTOOBJ is called to create an object reference to the server 'A' object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string in the form corbaloc:rir:/DataObjectA (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.
7. STRSET is called to create an unbounded string to which the stringified object reference to server 'B' is copied.
8. STRTOOBJ is called to create an object reference to the server 'B' object. This must be done to allow operation invocations on the server. In this case, the client identifies the target object, using a corbaloc URL string

in the form `corbaloc:rir:/DataObjectB` (as defined in point **1**). See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

9. `ORBTXNB` is called to indicate the start of two-phase commit processing. The next APPC conversation with the client adapter, which is established at the next call to `ORBEXEC`, will be at sync level 2.
10. `ORBEXEC` is called in this paragraph to read a value from server 'A'.
11. `ORBEXEC` is called in this paragraph to update a value from server 'A'. Server 'A' will log that an update has been requested, but make no actual changes.
12. `ORBEXEC` is called in this paragraph to read a value from server 'B'.
13. `ORBEXEC` is called in this paragraph to update a value from server 'B'. Server 'B' will log that an update has been requested, but make no actual changes.
14. If any call to `ORBEXEC` was unsuccessful, ask CICS to initiate rollback processing to undo the updates made by the servers. Server 'A' and 'B' will destroy the log that was holding the potential updates. No actual updates will be made.
15. `ORBTXNE` is called to indicate the end of two-phase commit processing. This requests that APPC deallocates the conversation. However, the actual deallocation does not occur until the two-phase commit processing has completed.
16. The CICS transaction calls `SYNCPOINT`. This triggers the start of two-phase commit processing. The client adapter is notified that the CICS transaction has initiated two-phase commit processing. The client adapter requests that server 'A' and server 'B' prepare their updates. Each server replies to the client adapter that they are either able or unable to commit the update. If either server replies that they are unable to commit the update, each server is asked to roll back and destroy the log that was holding the potential update. If both servers reply that they are able to commit the changes, the client adapter requests each server to commit their changes. Two-phase commit processing ends.

Location of the DATACL module

You can find a complete version of the CICS `DATACL` client module in *`orbixhlq`*`.DEMO.CICS.CBL.SRC(DATACL)`.

Building the Client

JCL to run the Orbix IDL compiler

Before you can build the client, you must run the Orbix IDL compiler on the IDL supplied in *orbixhlq*.DEMO.IDL(DATA). Sample JCL to do this can be found in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(DATAIDL).

JCL to build the client

Sample JCL used to compile and link the client can be found in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB(DATACB).

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.CICS.CBL.LOADLIB(DATACL).

Building the Servers

JCL to build the servers

Sample JCL used to run the IDL compiler, and compile and link the servers can be found in *orbixhlq*.DEMO.CPP.BLD.JCLLIB(DATASV).

Resulting load module

When the JCL has successfully executed, it results in a load module that is contained in *orbixhlq*.DEMO.CPP.LOADLIB(DATASV).

Preparing the Client to Run in CICS

Overview

This section describes the required steps to allow the client to run in a CICS region. These steps assume you want to run the CICS client against a batch server.

Steps

The steps to enable the client to run in a CICS region are:

Step	Action
1	Define a transaction to CICS.
2	Provide the CICS client load module to the CICS region.
3	Start the locator, node daemon, and RRS OTSTM on the server host.
4	Start the batch servers.
5	Customize the batch server IORs.
6	Configure and run the client adapter.

Step 1—Define a transaction to CICS

A transaction definition must be created for the client, to allow it to run in CICS. The following is the transaction definition for the supplied demonstration:

```
DEFINE   TRANSACTION(DATC)
         GROUP(ORXDEMO)
         DESCRIPTION(Orbix Client Two-Phase Commit demo transaction)
         PROGRAM(DATACL)
         PROFILE(DFHCICSA)
         TRANCLASS(DFHTCL00)
         DTIMOUT(10)
         SPURGE(YES)
         TPURGE(YES)
         RESSEC(YES)
```

Step 2—Provide client load module to CICS region

Ensure that the *orbixhlq*.DEMO.CICS.CBL.LOADLIB PDS is added to the DFHRPL for the CICS region that is to run the transaction.

Note: If you have already done this for your CICS server load module, you do not need to do this again.

Alternatively, you can copy the DATACL load module to a PDS in the DFHRPL of the relevant CICS region.

Step 3—Start locator, node daemon, and RRS OTSTM on server

This step assumes that you intend running the CICS client against the demonstration batch server.

In this case, you must start all of the following on the batch server host (if they have not already been started):

1. Start the locator daemon by submitting *orbixhlq*.JCLLIB(LOCATOR).
2. Start the node daemon by submitting *orbixhlq*.JCLLIB(NODEDAEM).
3. Start the RRS OTSTM server by submitting *orbixhlq*.JCLLIB(OTSTM).

See “Running the Server and Client” on page 45 for more details of running the locator and node daemon on the batch server host.

See the chapter on Using OTS RRS Transaction Manager in the *Mainframe OTS Guide* for more details of running the RRS OTSTM server

Step 4—Start batch servers

This step assumes that you intend running the CICS client against the demonstration batch servers.

Submit the *orbixhlq*.DEMO.CPP.RUN.JCLLIB(DATAA) and *orbixhlq*.DEMO.CPP.RUN.JCLLIB(DATAB) JCL to start the batch servers.

Step 5—Customize batch server IORs

When you run the demonstration batch servers they publish their IORs to *orbixhlq*.DEMO.IORS(DATAA) and *orbixhlq*.DEMO.IORS(DATAB).

The demonstration CICS client needs to use these IORs to contact the demonstration batch servers. The demonstration CICS client obtains the object reference for the demonstration batch servers in the form of a corbaloc URL string. A corbaloc URL string can take different formats. For the purposes of this demonstration, the corbalocs take the form `corbaloc:rir:/DataObjectA` and `corbaloc:rir:/DataObjectB`.

This form of the corbaloc URL string requires the use of the configuration variables, `initial_references:DataObjectA:reference` and `initial_references:DataObjectB:reference`, in the configuration domain. When you submit the JCL in *orbixhlq*.DEMO.CICS.CBL.BLD.JCLLIB (DATAIORS), it automatically adds these configuration entries to the configuration domain:

```
initial_references:DataObjectA:reference = "IOR…";
initial_references:DataObjectB:reference = "IOR…";
```

The IOR values are taken from *orbixhlq*.DEMO.IORS(DATAA) and *orbixhlq*.DEMO.IORS(DATAB).

See "STRTOOBJ" on page 514 for more details of the various forms of corbaloc URL strings and the ways you can use them.

Step 6—Configure and run client adapter

The client adapter must now be configured before you can start the client (the CICS transaction). See the *CICS Adapters Administrator's Guide* for details of how to configure the client adapter.

When you have configured the client adapter, you can run it by submitting *orbixhlq*.JCLLIB(CICSCA).

Note: See "Running a CICS Two-Phase Commit Client against Batch Servers" on page 194 for details of how to run the sample two-phase commit client demonstration.

Running the Demonstrations

Overview

This section provides a summary of what you need to do to successfully run the supplied demonstrations.

In this section

This section discusses the following topics:

Running a Batch Client against a CICS Server

Overview

This subsection describes what you need to do to successfully run the demonstration batch client against the demonstration CICS server. It also provides an overview of the output produced.

Steps

The steps to run the demonstration CICS server against the demonstration batch client are:

1. Ensure that all the steps in "Preparing the Server to Run in CICS" on page 155 have been successfully completed.
2. Run the batch client as described in "Running the Server and Client" on page 45.

CICS server output

The CICS server sends the following output to the CICS region:

```
Simple::call_me:IDL:Simple/SimpleObject:1.0 invoked
```

Batch client output

The batch client produces the following output:

```
Initializing the ORB
Registering the Interface
Reading object reference from file
invoking Simple::call_me:IDL:Simple/SimpleObject:1.0
Simple demo complete.
```

Running a CICS Client against a Batch Server

Overview

This subsection describes what you need to do to successfully run the demonstration CICS client against the demonstration batch server. It also provides an overview of the output produced.

Steps

The steps to run the demonstration CICS client against the demonstration batch server are:

1. Ensure that all the steps in "Preparing the Client to Run in CICS" on page 166 have been successfully completed.
2. Run the CICS client by entering the transaction name, `SMCL`, in the relevant CICS region.

CICS client output

The CICS client sends the following output to the CICS region:

```
Initializing the ORB
Registering the Interface
invoking Simple::call_me:IDL:Simple/SimpleObject:1.0
Simple demo complete.
```

The CICS client sends the following output to the CICS terminal:

```
Simple transaction completed
```

Batch server output

The batch server produces the following output:

```
Initializing the ORB
Registering the Interface
Creating the Object
Writing object reference to file
Giving control to the ORB to process Requests
Simple::call_me:IDL:Simple/SimpleObject:1.0 invoked
```

Running a CICS Two-Phase Commit Client against Batch Servers

Overview

This subsection describes what you need to do to successfully run the demonstration CICS two-phase commit client against the demonstration batch servers. It also provides an overview of the output produced.

Note: For instructions on recovery processing for any unsuccessful runs of an application, see *orbixhlq*.DEMO.CICS.CBL.README(DATAC).

Steps

The steps to run the demonstration CICS two-phase commit client against the demonstration batch servers are:

1. Ensure that all the steps in "Preparing the Client to Run in CICS" on page 188 have been successfully completed.
2. Run the CICS client by entering the transaction name, `DATC`, in the relevant CICS region.

CICS client output

The CICS client sends the following output to the CICS region:

```
Initializing the ORB
Registering the Interface
Two-phase commit transaction begins
Invoking: read:IDL:Data:1.0
Successfully read a value from server A: 0000000001
New value for server A: 0000000002
Invoking: write:IDL:Data:1.0
Server A has successfully updated the value.
Invoking: read:IDL:Data:1.0
Successfully read a value from server B: 0000000001
New value for server B: 0000000002
Invoking: write:IDL:Data:1.0
Server B has successfully updated the value.
All updates successful -
request commit
Two-phase commit transaction ends
```

The CICS client sends the following output to the CICS terminal:

```
Two-phase commit transaction completed
```

Batch server 'A' output

Batch server 'A' produces the following output:

```
OTS Recovery Demo Server
Initializing the ORB
Server ID is A
IOR file is  DD:IORS(DATAA)
Data file is DD:DATA(DATAA)
Log file is DD:DATA(LOGA)
Resolving TransactionCurrent
Resolving RootPOA
Creating POA with REQUIRES OTS Policy
Creating POA with lifespan policy of PERSISTENT
Creating POA with an ID assignment of USER
Creating Data servant and object
Creating POA for Resource objects
Reading data from file DD:DATA(DATAA)
Value is 1
Writing object reference to DD:IORS(DATAA)
Activation POA for Data object
Data servant read() called
Read-only access: not registering Resoure object
Current value is 1
Data servant write() called
Getting coordinator for current transaction
Getting Transaction Identifier
Creating Resource servant
Activating Resource object
Registering Resource object with coordinator
Activating the Resource POA
Setting value to 2
Resource servant prepare() called
Voting to commit the transaction
Writing prepare record
Resource servant commit() called
Writing data to file DD:DATA(DATAA)
Deleting prepare record
Deactivating Resource object
Resource servant destructed
```

Batch server 'B' output

Batch server 'B' produces the following output:

```
OTS Recovery Demo Server
Initializing the ORB
Server ID is B
IOR file is  DD:IORS(DATAB)
Data file is DD:DATA(DATAB)
Log file is DD:DATA(LOGB)
Resolving TransactionCurrent
Resolving RootPOA
Creating POA with REQUIRES OTS Policy
Creating POA with lifespan policy of PERSISTENT
Creating POA with an ID assignment of USER
Creating Data servant and object
Creating POA for Resource objects
Reading data from file DD:DATA(DATAB)
Value is 1
Writing object reference to DD:IORS(DATAB)
Activation POA for Data object
Data servant read() called
Read-only access: not registering Resoure object
Current value is 1
Data servant write() called
Getting coordinator for current transaction
Getting Transaction Identifier
Creating Resource servant
Activating Resource object
Registering Resource object with coordinator
Activating the Resource POA
Setting value to 2
Resource servant prepare() called
Voting to commit the transaction
Writing prepare record
Resource servant commit() called
Writing data to file DD:DATA(DATAB)
Deleting prepare record
Deactivating Resource object
Resource servant destructed
```

IDL Interfaces

The CORBA Interface Definition Language (IDL) is used to describe the interfaces of objects in an enterprise application. An object's interface describes that object to potential clients through its attributes and operations, and their signatures. This chapter describes IDL semantics and uses.

In this chapter

This chapter discusses the following topics:

IDL

Overview

An IDL-defined object can be implemented in any language that IDL maps to, including C++, Java, COBOL, and PL/I. By encapsulating object interfaces within a common language, IDL facilitates interaction between objects regardless of their actual implementation. Writing object interfaces in IDL is therefore central to achieving the CORBA goal of interoperability between different languages and platforms.

IDL standard mappings

CORBA defines standard mappings from IDL to several programming languages, including C++, Java, COBOL, and PL/I. Each IDL mapping specifies how an IDL interface corresponds to a language-specific implementation. The Orbix IDL compiler uses these mappings to convert IDL definitions to language-specific definitions that conform to the semantics of that language.

Overall structure

You create an application's IDL definitions within one or more IDL modules. Each module provides a naming context for the IDL definitions within it. Modules and interfaces form naming scopes, so identifiers defined inside an interface need to be unique only within that interface.

IDL definition structure

In the following example, two interfaces, `Bank` and `Account`, are defined within the `BankDemo` module:

```
module BankDemo
{
interface Bank {
        //…
    };

    interface Account {
        //…
    };
};
```

Modules and Name Scoping

Resolving a name

To resolve a name, the IDL compiler conducts a search among the following scopes, in the order outlined:

1. The current interface.
2. Base interfaces of the current interface (if any).
3. The scopes that enclose the current interface.

Referencing interfaces

Interfaces can reference each other by name alone within the same module. If an interface is referenced from outside its module, its name must be fully scoped with the following syntax:

`module-name::interface-name`

For example, the fully scoped names of the `Bank` and `Account` interfaces shown in "IDL definition structure" on page 198 are, respectively, `BankDemo::Bank` and `BankDemo::Account`.

Nesting restrictions

A module cannot be nested inside a module of the same name. Likewise, you cannot directly nest an interface inside a module of the same name. To avoid name ambiguity, you can provide an intervening name scope as follows:

```
module A
{
    module B
    {
        interface A {
            //…
        };
    };
};
```

Interfaces

In this section

The following topics are discussed in this section:

Overview

Interfaces are the fundamental abstraction mechanism of CORBA. An interface defines a type of object, including the operations that object supports in a distributed enterprise application.

Every CORBA object has exactly one interface. However, the same interface can be shared by many CORBA objects in a system. CORBA object references specify CORBA objects (that is, interface instances). Each reference denotes exactly one object, which provides the only means by which that object can be accessed for operation invocations.

Because an interface does not expose an object's implementation, all members are public. A client can access variables in an object's implementation only through an interface's operations and attributes.

Operations and attributes

An IDL interface generally defines an object's behavior through operations and attributes:

- Operations of an interface give clients access to an object's behavior. When a client invokes an operation on an object, it sends a message to that object. The ORB transparently dispatches the call to the object, whether it is in the same address space as the client, in another address space on the same machine, or in an address space on a remote machine.

- An IDL attribute is short-hand for a pair of operations that get and, optionally, set values in an object.

Account interface IDL sample

In the following example, the `Account` interface in the `BankDemo` module describes the objects that implement the bank accounts:

```
module BankDemo
{
    typedef float CashAmount; // Type for representing cash
    typedef string AccountId; //Type for representing account ids
    //…
    interface Account {
        readonly attribute AccountId  account_id;
        readonly attribute CashAmount balance;

        void
        withdraw(in CashAmount amount)
        raises (InsufficientFunds);

        void
        deposit(in CashAmount amount);
    };
};
```

Code explanation

This interface has two readonly attributes, `AccountId` and `balance`, which are respectively defined as typedefs of the `string` and `float` types. The interface also defines two operations, `withdraw()` and `deposit()`, which a client can invoke on this object.

Interface Contents

IDL interface components

An IDL interface definition typically has the following components.

- Operation definitions.
- Attribute definitions
- Exception definitions.
- Type definitions.
- Constant definitions.

Of these, operations and attributes must be defined within the scope of an interface, all other components can be defined at a higher scope.

Operations

Overview

Operations of an interface give clients access to an object's behavior. When a client invokes an operation on an object, it sends a message to that object. The ORB transparently dispatches the call to the object, whether it is in the same address space as the client, in another address space on the same machine, or in an address space on a remote machine.

Operation components

IDL operations define the signature of an object's function, which client invocations on that object must use. The signature of an IDL operation is generally composed of three components:

- Return value data type.
- Parameters and their direction.
- Exception clause.

An operation's return value and parameters can use any data types that IDL supports.

Note: Not all CORBA 2.3 IDL data types are supported by COBOL or PL/I.

Operations IDL sample

In the following example, the `Account` interface defines two operations, `withdraw()` and `deposit()`, and an `InsufficientFunds` exception:

```
module BankDemo
{
    typedef float CashAmount;  // Type for representing cash
    //...
    interface Account {
        exception InsufficientFunds {};

        void
        withdraw(in CashAmount amount)
        raises (InsufficientFunds);

        void
        deposit(in CashAmount amount);
    };
};
```

Code explanation

On each invocation, both operations expect the client to supply an argument for the `amount` parameter, and return `void`. Invocations on the `withdraw()` operation can also raise the `InsufficientFunds` exception, if necessary.

Parameter direction

Each parameter specifies the direction in which its arguments are passed between client and object. Parameter-passing modes clarify operation definitions and allow the IDL compiler to accurately map operations to a target programming language. The COBOL runtime uses parameter-passing modes to determine in which direction or directions it must marshal a parameter.

Parameter-passing mode qualifiers

There are three parameter-passing mode qualifiers:

`in`	This means that the parameter is initialized only by the client and is passed to the object.
`out`	This means that the parameter is initialized only by the object and returned to the client.
`inout`	This means that the parameter is initialized by the client and passed to the server; the server can modify the value before returning it to the client.

In general, you should avoid using `inout` parameters. Because an `inout` parameter automatically overwrites its initial value with a new value, its usage assumes that the caller has no use for the parameter's original value. Thus, the caller must make a copy of the parameter in order to retain that value. By using the two parameters, `in` and `out`, the caller can decide for itself when to discard the parameter.

One-way operations

By default, IDL operations calls are *synchronous*—that is, a client invokes an operation on an object and blocks until the invoked operation returns. If an operation definition begins with the keyword, `oneway`, a client that calls the operation remains unblocked while the object processes the call.

Note: The COBOL runtime does not support one-way operations.

Attributes

Overview

An interface's attributes correspond to the variables that an object implements. Attributes indicate which variable in an object are accessible to clients.

Qualified and unqualified attributes

Unqualified attributes map to a pair of `get` and `set` functions in the implementation language, which allow client applications to read and write attribute values. An attribute that is qualified with the `readonly` keyword maps only to a `get` function.

IDL readonly attributes sample

For example the `Account` interface defines two readonly attributes, `AccountId` and `balance`. These attributes represent information about the account that only the object's implementation can set; clients are limited to readonly access:

```
module BankDemo
{
    typedef float CashAmount; // Type for representing cash
    typedef string AccountId; //Type for representing account ids
    //…
    interface Account {
        readonly attribute AccountId  account_id;
        readonly attribute CashAmount balance;

        void
        withdraw(in CashAmount amount)
        raises (InsufficientFunds);

        void
        deposit(in CashAmount amount);
    };
};
```

Code explanation

The `Account` interface has two readonly attributes, `AccountId` and `balance`, which are respectively defined as typedefs of the `string` and `float` types. The interface also defines two operations, `withdraw()` and `deposit()`, which a client can invoke on this object.

Exceptions

IDL and exceptions

IDL operations can raise one or more CORBA-defined system exceptions. You can also define your own exceptions and explicitly specify these in an IDL operation. An IDL exception is a data structure that can contain one or more member fields, formatted as follows:

```
exception exception-name {
     [member;]…
};
```

Exceptions that are defined at module scope are accessible to all operations within that module; exceptions that are defined at interface scope are accessible on to operations within that interface.

The raises clause

After you define an exception, you can specify it through a `raises` clause in any operation that is defined within the same scope. A `raises` clause can contain multiple comma-delimited exceptions:

```
return-val operation-name( [params-list] )
    raises( exception-name[, exception-name] );
```

Example of IDL-defined exceptions

The `Account` interface defines the `InsufficientFunds` exception with a single member of the `string` data type. This exception is available to any operation within the interface. The following IDL defines the `withdraw()` operation to raise this exception when the withdrawal fails:

```
module BankDemo
{
    typedef float CashAmount;  // Type for representing cash
    //…
    interface Account {
        exception InsufficientFunds {};

        void
        withdraw(in CashAmount amount)
        raises (InsufficientFunds);
        //…
    };
};
```

Empty Interfaces

Defining empty interfaces

IDL allows you to define empty interfaces. This can be useful when you wish to model an abstract base interface that ties together a number of concrete derived interfaces.

IDL empty interface sample

In the following example, the CORBA `PortableServer` module defines the abstract `Servant Manager` interface, which serves to join the interfaces for two servant manager types, `ServantActivator` and `ServantLocator`:

```
module PortableServer
{
    interface ServantManager {};

    interface ServantActivator : ServantManager {
        //…
    };

    interface ServantLocator : ServantManager {
        //…
    };
};
```

Inheritance of Interfaces

Inheritance overview

An IDL interface can inherit from one or more interfaces. All elements of an inherited, or *base* interface, are available to the *derived* interface. An interface specifies the base interfaces from which it inherits, as follows:

```
interface new-interface : base-interface[, base-interface]…
{…};
```

Inheritance interface IDL sample

In the following example, the `CheckingAccount` and `SavingsAccount` interfaces inherit from the `Account` interface, and implicitly include all its elements:

```
module BankDemo{
    typedef float CashAmount;  // Type for representing cash
    interface Account {
        //…
    };

    interface CheckingAccount : Account {
        readonly attribute CashAmount overdraftLimit;
        boolean orderCheckBook ();
    };

    interface SavingsAccount : Account {
        float calculateInterest ();
    };
};
```

Code sample explanation

An object that implements the `CheckingAccount` interface can accept invocations on any of its own attributes and operations as well as invocations on any of the elements of the `Account` interface. However, the actual implementation of elements in a `CheckingAccount` object can differ from the implementation of corresponding elements in an `Account` object. IDL inheritance only ensures type-compatibility of operations and attributes between base and derived interfaces.

Multiple Inheritance

Multiple inheritance IDL sample

In the following IDL definition, the `BankDemo` module is expanded to include the `PremiumAccount` interface, which inherits from the `CheckingAccount` and `SavingsAccount` interfaces:

```
module BankDemo {
    interface Account {
        //…
    };

    interface CheckingAccount : Account {
        //…
    };

    interface SavingsAccount : Account {
        //…
    };

    interface PremiumAccount :
        CheckingAccount, SavingsAccount {
        //…
    };
};
```

Multiple inheritance constraints

Multiple inheritance can lead to name ambiguity among elements in the base interfaces. The following constraints apply:

- Names of operations and attributes must be unique across all base interfaces.
- If the base interfaces define constants, types, or exceptions of the same name, references to those elements must be fully scoped.

Inheritance hierarchy diagram

Figure 6 shows the inheritance hierarchy for the `Account` interface, which is defined in "Multiple inheritance IDL sample" on page 209.

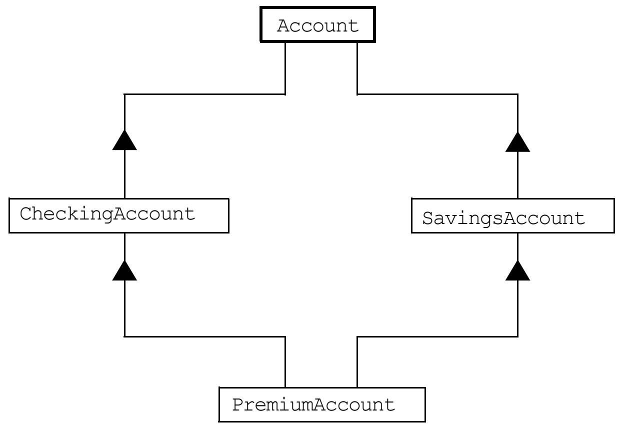

Figure 6: *Inheritance Hierarchy for PremiumAccount Interface*

Inheritance of the Object Interface

User-defined interfaces

All user-defined interfaces implicitly inherit the predefined interface `Object`. Thus, all `Object` operations can be invoked on any user-defined interface. You can also use `Object` as an attribute or parameter type to indicate that any interface type is valid for the attribute or parameter.

Object locator IDL sample

For example, the following operation `getAnyObject()` serves as an all-purpose object locator:

```
interface ObjectLocator {
    void getAnyObject (out Object obj);
};
```

Note: It is illegal in IDL syntax to explicitly inherit the `Object` interface.

Inheritance Redefinition

Overview

A derived interface can modify the definitions of constants, types, and exceptions that it inherits from a base interface. All other components that are inherited from a base interface cannot be changed.

Inheritance redefinition IDL sample

In the following example, the `CheckingAccount` interface modifies the definition of the `InsufficientFunds` exception, which it inherits from the `Account` interface:

```
module BankDemo
{
    typedef float CashAmount;  // Type for representing cash
    //…
    interface Account {
        exception InsufficientFunds {};
        //…
    };
    interface CheckingAccount : Account {
        exception InsufficientFunds {
            CashAmount overdraftLimit;
        };
    };
    //…
};
```

Note: While a derived interface definition cannot override base operations or attributes, operation overloading is permitted in interface implementations for those languages, such as C++, which support it. However, COBOL does not support operation overloading.

Forward Declaration of IDL Interfaces

Overview

An IDL interface must be declared before another interface can reference it. If two interfaces reference each other, the module must contain a forward declaration for one of them; otherwise, the IDL compiler reports an error. A forward declaration only declares the interface's name; the interface's actual definition is deferred until later in the module.

Forward declaration IDL sample

In the following example, the `Bank` interface defines a `create_account()` and `find_account()` operation, both of which return references to `Account` objects. Because the `Bank` interface precedes the definition of the `Account` interface, `Account` is forward-declared:

```
module BankDemo
{
    typedef float CashAmount; // Type for representing cash
    typedef string AccountId; //Type for representing account ids

    // Forward declaration of Account
    interface Account;

    // Bank interface...used to create Accounts
    interface Bank {
        exception AccountAlreadyExists { AccountId account_id; };
        exception AccountNotFound      { AccountId account_id; };

        Account
        find_account(in AccountId account_id)
        raises(AccountNotFound);

        Account
        create_account(
            in AccountId account_id,
            in CashAmount initial_balance
        ) raises (AccountAlreadyExists);
    };

    // Account interface…used to deposit, withdraw, and query
    // available funds.
    interface Account { //…
    };
};
```

Local Interfaces

Overview

An interface declaration that contains the IDL `local` keyword defines a *local interface*. An interface declaration that omits this keyword can be referred to as an *unconstrained interface*, to distinguish it from local interfaces. An object that implements a local interface is a *local object*.

Note: The COBOL runtime and the Orbix IDL compiler backend for COBOL do not support local interfaces.

Valuetypes

Overview

Valuetypes enable programs to pass objects by value across a distributed system. This type is especially useful for encapsulating lightweight data such as linked lists, graphs, and dates.

> **Note:** The COBOL runtime and the Orbix IDL compiler backend for COBOL do not support valuetypes.

Abstract Interfaces

Overview

An application can use abstract interfaces to determine at runtime whether an object is passed by reference or by value.

Note: The COBOL runtime and the Orbix IDL compiler backend for COBOL do not support abstract interfaces.

IDL Data Types

In this section

The following topics are discussed in this section:

Data type categories

In addition to IDL module, interface, valuetype, and exception types, IDL data types can be grouped into the following categories:

- Built-in types such as `short`, `long`, and `float`.
- Extended built-in types such as `long long` and `wstring`.
- Complex types such as `enum`, `struct`, and `string`.
- Pseudo objects.

Note: Not all CORBA 2.3 IDL data types are supported by COBOL or PL/I.

Built-in Data Types

List of types, sizes, and values

Table 16 shows a list of CORBA IDL built-in data types (where the ≤ symbol means 'less than or equal to').

Table 16: *Built-in IDL Data Types, Sizes, and Values*

Data type	Size	Range of values
short	≤ 16 bits	$-2^{15}...2^{15}-1$
unsigned short	≤ 16 bits	$0...2^{16}-1$
long	≤ 32 bits	$-2^{31}...2^{31}-1$
unsigned long	≤ 32 bits	$0...2^{32}-1$
float	≤ 32 bits	IEEE single-precision floating point numbers
double	≤ 64 bits	IEEE double-precision floating point numbers
char	≤ 8 bits	ISO Latin-1
string	Variable length	ISO Latin-1, except NUL
string<bound>	Variable length	ISO Latin-1, except NUL
boolean	Unspecified	`TRUE` or `FALSE`
octet	≤ 8 bits	`0x0` to `0xff`
any	Variable length	Universal container type

Floating point types

The float and double types follow IEEE specifications for single-precision and double-precision floating point values, and on most platforms map to native IEEE floating point types.

Char type

The `char` type can hold any value from the ISO Latin-1 character set. Code positions 0-127 are identical to ASCII. Code positions 128-255 are reserved for special characters in various European languages, such as accented vowels.

String type

The `string` type can hold any character from the ISO Latin-1 character set, except `NUL`. IDL prohibits embedded `NUL` characters in strings. Unbounded string lengths are generally constrained only by memory limitations. A bounded string, such as `string<10>`, can hold only the number of characters specified by the bounds, excluding the terminating `NUL` character. Thus, a `string<6>` can contain the six-character string, `cheese`.

Bounded and unbounded strings

The declaration statement can optionally specify the string's maximum length, thereby determining whether the string is bounded or unbounded:

```
string[length] name
```

For example, the following code declares the `ShortString` type, which is a bounded string with a maximum length of 10 characters:

```
typedef string<10> ShortString;
attribute ShortString shortName; // max length is 10 chars
```

Octet type

`Octet` types are guaranteed not to undergo any conversions in transit. This lets you safely transmit binary data between different address spaces. Avoid using the `char` type for binary data, inasmuch as characters might be subject to translation during transmission. For example, if a client that uses ASCII sends a string to a server that uses EBCDIC, the sender and receiver are liable to have different binary values for the string's characters.

Any type

The `any` type allows specification of values that express any IDL type, which is determined at runtime; thereby allowing a program to handle values whose types are not known at compile time. An `any` logically contains a `TypeCode` and a value that is described by the `TypeCode`. A client or server can construct an `any` to contain an arbitrary type of value and then pass this call in a call to the operation. A process receiving an `any` must determine what type of value it stores and then extract the value via the TypeCode. Refer to the *CORBA Programmer's Guide, C++* for more details about the `any` type.

Extended Built-in Data Types

List of types, sizes, and values

Table 17 shows a list of CORBA IDL extended built-in data types (where the ≤ symbol means 'less than or equal to').

Table 17: *Extended built-in IDL Data Types, Sizes, and Values*

Data Type	Size	Range of Values
long long[a]	≤ 64 bits	$-2^{63}...2^{63}-1$
unsigned long long[a]	≤ 64 bits	$0...-2^{64}-1$
long double[b]	≤ 79 bits	IEEE double-extended floating point number, with an exponent of at least 15 bits in length and signed fraction of at least 64 bits. The `long double` type is currently not supported on Windows NT.
wchar	Unspecified	Arbitrary codesets
wstring	Variable length	Arbitrary codesets
fixed[c]	Unspecified	≤ 31significant digits

a. Due to compiler restrictions, the COBOL range of values for the `long long` and `unsigned long long` types is the same range as for a `long` type (that is, $0...2^{31}-1$).

b. Due to compiler restrictions, the COBOL range of values for the `long double` type is the same range as for a double type (that is, ≤ 64 bits).

c. Due to compiler restrictions, the COBOL range of values for the fixed type is ≤ 18 significant digits.

Long long type

The 64-bit integer types, `long long` and `unsigned long long`, support numbers that are too large for 32-bit integers. Platform support varies. If you compile IDL that contains one of these types on a platform that does not support it, the compiler issues an error.

Long double type

Like 64-bit integer types, platform support varies for the `long double` type, so usage can yield IDL compiler errors.

Wchar type

The `wchar` type encodes wide characters from any character set. The size of a `wchar` is platform-dependent. Because Orbix currently does not support character set negotiation, use this type only for applications that are distributed across the same platform.

Wstring type

The `wstring` type is the wide-character equivalent of the `string` type. Like `string` types, `wstring` types can be unbounded or bounded. Wide strings can contain any character except `NUL`.

Fixed type

IDL specifies that the `fixed` type provides fixed-point arithmetic values with up to 31 significant digits. However, due to restrictions in earlier versions of the COBOL compiler, only up to 18 significant digits were originally supported. Because more recent COBOL compilers provide an `ARITH(EXTEND)` option that provides support for 31 digits, the IDL compiler also supports 31 digits when the `-E` IDL compiler argument is used. See "-E Argument" on page 335 for details.

You specify a `fixed` type with the following format:

```
typedef fixed<digit-size,scale> name
```

The format for the fixed type can be explained as follows:

- The *`digit-size`* represents the number's length in digits. The maximum value for *`digit-size`* is 31 and it must be greater than *`scale`*. A `fixed` type can hold any value up to the maximum value of a `double` type.
- If *`scale`* is a positive integer, it specifies where to place the decimal point relative to the rightmost digit. For example, the following code declares a fixed type, `CashAmount`, to have a digit size of 10 and a scale of 2:

  ```
  typedef fixed<10,2> CashAmount;
  ```

  Given this typedef, any variable of the `CashAmount` type can contain values of up to (+/-)99999999.99.

- If *`scale`* is a negative integer, the decimal point moves to the right by the number of digits specified for *`scale`*, thereby adding trailing zeros to the fixed data type's value. For example, the following code declares a fixed type, `bigNum`, to have a digit size of `3` and a scale of `-4`:

  ```
  typedef fixed <3,-4> bigNum;
  bigNum myBigNum;
  ```

  If `myBigNum` has a value of `123`, its numeric value resolves to `1230000`. Definitions of this sort allow you to efficiently store numbers with trailing zeros.

Constant fixed types

Constant fixed types can also be declared in IDL, where *`digit-size`* and *`scale`* are automatically calculated from the constant value. For example:

```
module Circle {
    const fixed pi = 3.142857;
};
```

This yields a fixed type with a digit size of `7`, and a scale of `6`.

Fixed type and decimal fractions

Unlike IEEE floating-point values, the `fixed` type is not subject to representational errors. IEEE floating point values are liable to inaccurately represent decimal fractions unless the value is a fractional power of 2. For example, the decimal value 0.1 cannot be represented exactly in IEEE format. Over a series of computations with floating-point values, the cumulative effect of this imprecision can eventually yield inaccurate results.

The `fixed` type is especially useful in calculations that cannot tolerate any imprecision, such as computations of monetary values.

Complex Data Types

IDL complex data types

IDL provide the following complex data types:

- Enums.
- Structs.
- Multi-dimensional fixed-sized arrays.
- Sequences.

Enum Data Type

Overview

An enum (enumerated) type lets you assign identifiers to the members of a set of values.

Enum IDL sample

For example, you can modify the `BankDemo` IDL with the `balanceCurrency` enum type:

```
module BankDemo {
    enum Currency {pound, dollar, yen, franc};

    interface Account {
        readonly attribute CashAmount balance;
        readonly attribute Currency balanceCurrency;
        //…
    };
};
```

In the preceding example, the `balanceCurrency` attribute in the `Account` interface can take any one of the values `pound`, `dollar`, `yen`, or `franc`.

Ordinal values of enum type

The ordinal values of an enum type vary according to the language implementation. The CORBA specification only guarantees that the ordinal values of enumerated types monotonically increase from left to right. Thus, in the previous example, `dollar` is greater than `pound`, `yen` is greater than `dollar`, and so on. All enumerators are mapped to a 32-bit type.

Struct Data Type

Overview

A struct type lets you package a set of named members of various types.

Struct IDL sample

In the following example, the `CustomerDetails` struct has several members. The `getCustomerDetails()` operation returns a struct of the `CustomerDetails` type, which contains customer data:

```
module BankDemo{
        struct CustomerDetails {
            string custID;
            string lname;
            string fname;
            short age;
            //…
        };

        interface Bank {
            CustomerDetails getCustomerDetails
                (in string custID);
            //…
        };
};
```

Note: A struct type must include at least one member. Because a struct provides a naming scope, member names must be unique only within the enclosing structure.

Union Data Type

Overview

A union type lets you define a structure that can contain only one of several alternative members at any given time. A union type saves space in memory, because the amount of storage required for a union is the amount necessary to store its largest member.

Union declaration syntax

You declare a union type with the following syntax:

```
union name switch (discriminator) {
    case label1 : element-spec;
    case label2 : element-spec;
    […]
    case labeln : element-spec;
    [default : element-spec;]
};
```

Discriminated unions

All IDL unions are *discriminated*. A discriminated union associates a constant expression (`label1…labeln`) with each member. The discriminator's value determines which of the members is active and stores the union's value.

IDL union date sample

The following IDL defines a `Date` union type, which is discriminated by an enum value:

```
enum dateStorage
{ numeric, strMMDDYY, strDDMMYY };

struct DateStructure {
    short Day;
    short Month;
    short Year;
};

union Date switch (dateStorage) {
    case numeric: long digitalFormat;
    case strMMDDYY:
    case strDDMMYY: string stringFormat;
    default: DateStructure structFormat;
};
```

Sample explanation

Given the preceding IDL:

- If the discriminator value for `Date` is numeric, the `digitalFormat` member is active.
- If the discriminator's value is `strMMDDYY` or `strDDMMYY`, the `stringFormat` member is active.
- If neither of the preceding two conditions apply, the default `structFormat` member is active.

Rules for union types

The following rules apply to union types:

- A union's discriminator can be `integer, char, boolean` or `enum`, or an alias of one of these types; all `case` label expressions must be compatible with the relevant type.
- Because a union provides a naming scope, member names must be unique only within the enclosing union.
- Each union contains a pair of values: the discriminator value and the active member.
- IDL unions allow multiple case labels for a single member. In the previous example, the `stringFormat` member is active when the discriminator is either `strMMDDYY` or `strDDMMYY`.
- IDL unions can optionally contain a `default` case label. The corresponding member is active if the discriminator value does not correspond to any other label.

Arrays

Overview

IDL supports multi-dimensional fixed-size arrays of any IDL data type, with the following syntax (where *dimension-spec* must be a non-zero positive constant integer expression):

```
[typedef] element-type array-name [dimension-spec]…
```

IDL does not allow open arrays. However, you can achieve equivalent functionality with sequence types.

Array IDL sample

For example, the following piece of code defines a two-dimensional array of bank accounts within a portfolio:

```
typedef Account portfolio[MAX_ACCT_TYPES][MAX_ACCTS]
```

Note: For an array to be used as a parameter, an attribute, or a return value, the array must be named by a typedef declaration. You can omit a typedef declaration only for an array that is declared within a structure definition.

Array indexes

Because of differences between implementation languages, IDL does not specify the origin at which arrays are indexed. For example, C and C++ array indexes always start at 0, while COBOL, PL/I, and Pascal use an origin of 1. Consequently, clients and servers cannot exchange array indexes unless they both agree on the origin of array indexes and make adjustments as appropriate for their respective implementation languages. Usually, it is easier to exchange the array element itself instead of its index.

Sequence

Overview

IDL supports sequences of any IDL data type with the following syntax:

[typedef] sequence < *element-type[, max-elements]* > *sequence-name*

An IDL sequence is similar to a one-dimensional array of elements; however, its length varies according to its actual number of elements, so it uses memory more efficiently.

For a sequence to be used as a parameter, an attribute, or a return value, the sequence must be named by a typedef declaration, to be used as a parameter, an attribute, or a return value. You can omit a typedef declaration only for a sequence that is declared within a structure definition.

A sequence's element type can be of any type, including another sequence type. This feature is often used to model trees.

Bounded and unbounded sequences

The maximum length of a sequence can be fixed (bounded) or unfixed (unbounded):

- Unbounded sequences can hold any number of elements, up to the memory limits of your platform.
- Bounded sequences can hold any number of elements, up to the limit specified by the bound.

Bounded and unbounded IDL definitions

The following code shows how to declare bounded and unbounded sequences as members of an IDL struct:

```
struct LimitedAccounts {
    string bankSortCode<10>;
    sequence<Account, 50> accounts; // max sequence length is 50
};

struct UnlimitedAccounts {
    string bankSortCode<10>;
    sequence<Account> accounts; // no max sequence length
};
```

Pseudo Object Types

Overview

CORBA defines a set of pseudo-object types that ORB implementations use when mapping IDL to a programming language. These object types have interfaces defined in IDL; however, these object types do not have to follow the normal IDL mapping rules for interfaces and they are not generally available in your IDL specifications.

Note: The COBOL runtime and the Orbix IDL compiler backend for COBOL do not support all pseudo object types.

Defining Data Types

In this section

This section contains the following subsections:

Using typedef

With `typedef`, you can define more meaningful or simpler names for existing data types, regardless of whether those types are IDL-defined or user-defined.

Typedef identifier IDL sample

The following code defines the `typedef` identifier, `StandardAccount`, so that it can act as an alias for the `Account` type in later IDL definitions:

```
module BankDemo {
    interface Account {
        //…
    };

    typedef Account StandardAccount;
};
```

Constants

Overview

IDL lets you define constants of all built-in types except the `any` type. To define a constant's value, you can use either another constant (or constant expression) or a literal. You can use a constant wherever a literal is permitted.

Integer constants

IDL accepts integer literals in decimal, octal, or hexadecimal:

```
const short     I1 = -99;
const long      I2 = 0123;  // Octal 123, decimal 83
const long long I3 = 0x123; // Hexadecimal 123, decimal 291
const long long I4 = +0xaB; // Hexadecimal ab, decimal 171
```

Both unary plus and unary minus are legal.

Floating-point constants

Floating-point literals use the same syntax as C++:

```
const float       f1 = 3.1e-9; // Integer part, fraction part,
                               // exponent
const double      f2 = -3.14;  // Integer part and fraction part
const long double f3 = .1      // Fraction part only
const double      f4 = 1.      // Integer part only
const double      f5 = .1E12   // Fraction part and exponent
const double      f6 = 2E12    // Integer part and exponent
```

Character and string constants

Character constants use the same escape sequences as C++:

Example 12: *List of character constants (Sheet 1 of 2)*

```
const char C1 = 'c';        // the character c
const char C2 = '\007';     // ASCII BEL, octal escape
const char C3 = '\x41';     // ASCII A, hex escape
const char C4 = '\n';       // newline
const char C5 = '\t';       // tab
const char C6 = '\v';       // vertical tab
const char C7 = '\b';       // backspace
const char C8 = '\r';       // carriage return
const char C9 = '\f';       // form feed
const char C10 = '\a';      // alert
```

Example 12: *List of character constants (Sheet 2 of 2)*

```
const char C11 = '\\';      // backslash
const char C12 = '\?';      // question mark
const char C13 = '\'';      // single quote
// String constants support the same escape sequences as C++
const string S1 = "Quote: \"";      // string with double quote
const string S2 = "hello world";    // simple string
const string S3 = "hello" " world"; // concatenate
const string S4 = "\xA" "B";        // two characters
                                    // ('\xA' and 'B'),
                               // not the single character '\xAB'
```

Wide character and string constants

Wide character and string constants use C++ syntax. Use universal character codes to represent arbitrary characters. For example:

```
const wchar     C = L'X';
const wstring   GREETING = L"Hello";
const wchar     OMEGA = L'\u03a9';
const wstring   OMEGA_STR = L"Omega: \u3A9";
```

IDL files always use the ISO Latin-1 code set; they cannot use Unicode or other extended character sets.

Boolean constants

Boolean constants use the `FALSE` and `TRUE` keywords. Their use is unnecessary, inasmuch as they create unnecessary aliases:

```
// There is no need to define boolean constants:
const CONTRADICTION = FALSE;    // Pointless and confusing
const TAUTOLOGY = TRUE;         // Pointless and confusing
```

Octet constants

Octet constants are positive integers in the range 0-255.

```
const octet O1 = 23;
const octet O2 = 0xf0;
```

Octet constants were added with CORBA 2.3; therefore, ORBs that are not compliant with this specification might not support them.

Fixed-point constants

For fixed-point constants, you do not explicitly specify the digits and scale. Instead, they are inferred from the initializer. The initializer must end in `d` or `D`. For example:

```
// Fixed point constants take digits and scale from the
// initializer:
const fixed val1 = 3D;          // fixed<1,0>
const fixed val2 = 03.14d;      // fixed<3,2>
const fixed val3 = -03000.00D;  // fixed<4,0>
const fixed val4 = 0.03D;       // fixed<3,2>
```

The type of a fixed-point constant is determined after removing leading and trailing zeros. The remaining digits are counted to determine the digits and scale. The decimal point is optional.

Currently, there is no way to control the scale of a constant if it ends in trailing zeros.

Enumeration constants

Enumeration constants must be initialized with the scoped or unscoped name of an enumerator that is a member of the type of the enumeration. For example:

```
enum Size { small, medium, large }

const Size DFL_SIZE = medium;
const Size MAX_SIZE = ::large;
```

Enumeration constants were added with CORBA 2.3; therefore, ORBs that are not compliant with this specification might not support them.

Constant Expressions

Overview

IDL provides a number of arithmetic and bitwise operators. The arithmetic operators have the usual meaning and apply to integral, floating-point, and fixed-point types (except for `%`, which requires integral operands). However, these operators do not support mixed-mode arithmetic: you cannot, for example, add an integral value to a floating-point value.

Arithmetic operators

The following code contains several examples of arithmetic operators:

```
// You can use arithmetic expressions to define constants.
const long MIN = -10;
const long MAX = 30;
const long DFLT = (MIN + MAX) / 2;

// Can't use 2 here
const double TWICE_PI = 3.1415926 * 2.0;

// 5% discount
const fixed DISCOUNT = 0.05D;
const fixed PRICE = 99.99D;

// Can't use 1 here
const fixed NET_PRICE = PRICE * (1.0D - DISCOUNT);
```

Evaluating expressions for arithmetic operators

Expressions are evaluated using the type promotion rules of C++. The result is coerced back into the target type. The behavior for overflow is undefined, so do not rely on it. Fixed-point expressions are evaluated internally with 31 bits of precision, and results are truncated to 15 digits.

Bitwise operators

Bitwise operators only apply to integral types. The right-hand operand must be in the range 0-63. The right-shift operator, >>, is guaranteed to insert zeros on the left, regardless of whether the left-hand operand is signed or unsigned.

```
// You can use bitwise operators to define constants.
const long ALL_ONES = -1;                // 0xffffffff
const long LHW_MASK = ALL_ONES << 16;    // 0xffff0000
const long RHW_MASK = ALL_ONES >> 16;    // 0x0000ffff
```

IDL guarantees two's complement binary representation of values.

Precedence

The precedence for operators follows the rules for C++. You can override the default precedence by adding parentheses.

IDL-to-COBOL Mapping

The CORBA Interface Definition Language (IDL) is used to define interfaces that are exposed by servers in your network. This chapter describes the standard IDL-to-COBOL mapping rules and shows, by example, how each IDL type is represented in COBOL.

In this chapter

This chapter discusses the following topics:

Note: See "IDL Interfaces" on page 197 for more details of the IDL types discussed in this chapter.

Mapping for Identifier Names

Overview

This section describes how IDL identifier names are mapped to COBOL.

COBOL rules for identifiers

The following rules apply for COBOL identifiers:

- They can be a maximum of 30 characters in length.
- They can only consist of alphanumeric and hyphen characters.

IDL-to-COBOL mapping rules for identifiers

The following rules are used to convert an IDL identifier to COBOL:

- Replace each underscore with a hyphen.
- Remove any leading or trailing hyphens.
- If an identifier clashes with a reserved COBOL word, prefix it with the characters `IDL-`. For example, `procedure` maps to `IDL-PROCEDURE`, `stop` maps to `IDL-STOP`, and `result` maps to `IDL-RESULT`.

  In this case, `PROCEDURE` and `STOP` are COBOL-reserved words, and `RESULT` is reserved by the Orbix IDL compiler for operation return types. The IDL compiler supports the COBOL-reserved words that pertain to the Enterprise COBOL compiler.
- If an identifier is greater than 30 characters, truncate it to 30 characters, by using the first 25 characters followed by a hyphen followed by a unique alphanumeric four-character suffix.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
module amodule {
{
    interface example
    {
       attribute boolean myverylongattribute;
       boolean myverylongopname(in boolean
           myverylongboolean);
    };
};
```

2. The preceding IDL maps to the following COBOL:

```
*************************************************************
* Interface:
*     amodule/example
*
* Mapped name:
*     amodule-example
*
* Inherits interfaces:
*     (none)
*************************************************************
*************************************************************
* Attribute:    myverylongattribute
* Mapped name:  myverylongattribute
* Type:        boolean (read/write)
*************************************************************
01 AMODULE-EXAMPLE-MYVE-5905-ARGS.
   03 RESULT                                  PICTURE 9(01)
                                              BINARY.
      88 RESULT-FALSE                         VALUE 0.
      88 RESULT-TRUE                          VALUE 1.
*************************************************************
* Operation:      myverylongopname
* Mapped name:    myverylongopname
* Arguments:      <in> boolean myverylongboolean
* Returns:        boolean
* User Exceptions: none
*************************************************************
01 AMODULE-EXAMPLE-MYVE-EAB7-ARGS.
   03 MYVERYLONGBOOLEAN                       PICTURE 9(01)
                                              BINARY.
      88 MYVERYLONGBOOLEAN-FALSE              VALUE 0.
      88 MYVERYLONGBOOLEAN-TRUE               VALUE 1.
   03 RESULT                                  PICTURE 9(01)
                                              BINARY.
      88 RESULT-FALSE                         VALUE 0.
      88 RESULT-TRUE                          VALUE 1.
```

Note: See "-M Argument" on page 338 and "-O Argument" on page 345 for details of the arguments that you can use with the Orbix IDL compiler to create alternative COBOL identifiers.

IDL identifier naming restriction

Consider the following example that has a `05` level data item called `MY-STRING` and a `07` level data item also called `MY-STRING`.

```
01 MYWORLD.
   03 MY-GROUP.
      05 MY-STRING                PICTURE X(10).
      05 MY-VALUES.
         07 MY-LONG               PICTURE 9(09) BINARY.
         07 MY-STRING             PICTURE X(10).
```

The COBOL compiler does not handle the scenario shown in the preceding example where two data names of the same name (`MY-STRING`) under the same `01` level are referenced, and the immediate parent of the highest level of these two data names (`MYGROUP`) is included in the path of the lower level data name (`MY-STRING OF MY-VALUES OF MY-GROUP OF MYWORLD`).

The following example illustrates how this restriction can manifest itself. First, consider the following IDL:

```
//sample.idl
interface sample
{
    struct ClmSum {
        short int_div_id;
    };

    typedef sequence<ClmSum,30> ClmSumSeq;
    struct MemClmRsp {
        string more_data_sw;
        short int_div_id;
        ClmSumSeq MemClmList;
    };
    short getSummary(out MemClmRsp MemClaimList);
};
```

In the preceding IDL example there are two structures that both use the same IDL field name, and one structure embeds the other. The IDL compiler generates the following data names in the main copybook for this IDL:

```
01 SAMPLE-GETSUMMARY-ARGS.
   03 MEMCLAIMLIST.
      05 MORE-DATA-SW POINTER VALUE NULL.
      05 INT-DIV-ID PICTURE S9(05) BINARY.
      05 MEMCLMLIST-1 OCCURS 30 TIMES.
         07 MEMCLMLIST.
            09 INT-DIV-ID PICTURE S9(05) BINARY.
      05 MEMCLMLIST-SEQUENCE.
         07 SEQUENCE-MAXIMUM PICTURE 9(09) BINARY VALUE 30.
         07 SEQUENCE-LENGTH PICTURE 9(09) BINARY VALUE 0.
         07 SEQUENCE-BUFFER POINTER VALUE NULL.
         07 SEQUENCE-TYPE POINTER VALUE NULL.
   03 RESULT PICTURE S9(05) BINARY.
```

In the preceding COBOL example, the data name `INT-DIV-ID` appears twice. When this is referenced in the COBOL application, it results in the following error at application compile time:

```
IGYPS0037-S INT-DIV-ID was not a uniquely defined name. The
   definition to be used could not be determined from the
   context. The reference to the name was discarded.
```

The only solutions available in such cases is to change either the conflicting identifier names in your generated COBOL copybooks or the original IDL itself, so that a clash does not occur at application compile time.

Mapping for Type Names

Overview

This section describes how IDL type names are mapped to COBOL.

IDL-to-COBOL mapping for type names

The current CORBA OMG COBOL mapping is based on the use of typedefs for naming some IDL types. Typedefs are a non-standard extension to the COBOL-85 standard. Earlier versions of the COBOL compiler did not support this extension.

The CORBA COBOL mapping standard includes a recent addition that proposes the use of `COPY … REPLACING` syntax instead of typedefs for type definitions. Orbix Mainframe currently uses the COBOL representation of each type directly.

Mapping for Basic Types

Overview

This section describes how basic IDL types are mapped to COBOL.

IDL-to-COBOL mapping for basic types

Table 18 shows the mapping rules for basic IDL types. Types not currently supported by Orbix COBOL are denoted by *italic* text. The CORBA typedef name is provided for reference purposes only; the COBOL representation is used directly.

Table 18: *Mapping for Basic IDL Types (Sheet 1 of 2)*

IDL Type	CORBA Typedef Name	COBOL Representation
short	CORBA-short	PIC S9(05) BINARY
long	CORBA-long	PIC S9(10) BINARY
unsigned short	CORBA-unsigned-short	PIC 9(05) BINARY
unsigned long	CORBA-unsigned-long	PIC 9(10) BINARY
float	CORBA-float	COMP-1
double	CORBA-double	COMP-2
char	CORBA-char	PIC X
boolean	CORBA-boolean	PIC 9(01) BINARY
octet	CORBA-octet	PIC X
enum	CORBA-enum	PIC 9(10) BINARY
fixed<d,s>	Fixed<d,s>	PIC S9(d-s)v(s) PACKED-DECIMAL
fixed<d,-s>	Fixed<d,-s>	PIC S9(d)P(s) PACKED-DECIMAL

Table 18: *Mapping for Basic IDL Types (Sheet 2 of 2)*

IDL Type	CORBA Typedef Name	COBOL Representation
any	CORBA-any	Refer to "Mapping for the Any Type" on page 281.
long long	*CORBA-long-long*	*PIC S9(18) BINARY*
unsigned long long	*CORBA-unsigned-long-long*	*PIC 9(18) BINARY*
wchar	*CORBA-wchar*	*PIC G*

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
const float my_outer_float = 19.76;
const double my_outer_double = 123456.789;

interface example
{
    const short my_short = 24;
    const long  my_long = 9999;
    typedef fixed<5,2> a_fixed_5_2;
    attribute short myshort;
    attribute long mylong;
    attribute unsigned short myushort;
    attribute unsigned long myulong;
    attribute float myfloat;
    attribute double mydouble;
    attribute char mychar;
    attribute octet myoctet;
    attribute a_fixed_5_2 myfixed_5_2;
    attribute long long mylonglong;
    attribute unsigned long long ulonglong;
};
```

2. The preceding IDL maps to the following COBOL:

Example 13: *COBOL Example for Basic Types (Sheet 1 of 3)*

```
*************************************************************
* Constants in root scope:
*************************************************************
01 GLOBAL-EXAM1A-CONSTS.
   03 MY-OUTER-FLOAT                       COMPUTATIONAL-1
                                           VALUE 1.976e+01.
   03 MY-OUTER-DOUBLE                      COMPUTATIONAL-2
                                           VALUE 1.23456789e+05.
*************************************************************
* Interface:
*     example
*
* Mapped name:
*     example
*
* Inherits interfaces:
*     (none)
*************************************************************
*************************************************************
* Attribute:    myshort
* Mapped name:  myshort
* Type:         short (read/write)
*************************************************************
01 EXAMPLE-MYSHORT-ARGS.
   03 RESULT                               PICTURE S9(05)
                                           BINARY.
*************************************************************
* Attribute:    mylong
* Mapped name:  mylong
* Type:         long (read/write)
*************************************************************
01 EXAMPLE-MYLONG-ARGS.
   03 RESULT                               PICTURE S9(10)
                                           BINARY.
*************************************************************
* Attribute:    myushort
* Mapped name:  myushort
* Type:         unsigned short (read/write)
*************************************************************
01 EXAMPLE-MYUSHORT-ARGS.
   03 RESULT                               PICTURE 9(05)
                                           BINARY.

*************************************************************
* Attribute:    myulong
```

Example 13: *COBOL Example for Basic Types (Sheet 2 of 3)*

```
* Mapped name:  myulong
* Type:         unsigned long (read/write)
***********************************************************
01 EXAMPLE-MYULONG-ARGS.
   03 RESULT                                PICTURE 9(10)
                                            BINARY.
***********************************************************
* Attribute:    myfloat
* Mapped name:  myfloat
* Type:         float (read/write)
***********************************************************
01 EXAMPLE-MYFLOAT-ARGS.
   03 RESULT                                COMPUTATIONAL-1.
***********************************************************
* Attribute:    mydouble
* Mapped name:  mydouble
* Type:         double (read/write)
***********************************************************
01 EXAMPLE-MYDOUBLE-ARGS.
   03 RESULT                                COMPUTATIONAL-2.
***********************************************************
* Attribute:    mychar
* Mapped name:  mychar
* Type:         char (read/write)
***********************************************************
01 EXAMPLE-MYCHAR-ARGS.
   03 RESULT                                PICTURE X(01).
***********************************************************
* Attribute:    myoctet
* Mapped name:  myoctet
* Type:         octet (read/write)
***********************************************************
01 EXAMPLE-MYOCTET-ARGS.
   03 RESULT                                PICTURE X(01).
***********************************************************
* Attribute:    myfixed_5_2
* Mapped name:  myfixed_5_2
* Type:         example/a_fixed_5_2 (read/write)
***********************************************************
01 EXAMPLE-MYFIXED-5-2-ARGS.
   03 RESULT                                PICTURE S9(3)V9(2)
                                            PACKED-DECIMAL.

***********************************************************
* Attribute:    mylonglong
```

Example 13: *COBOL Example for Basic Types (Sheet 3 of 3)*

```
* Mapped name:  mylonglong
* Type:         long long (read/write)
***********************************************************
01 EXAMPLE-MYLONGLONG-ARGS.
   03 RESULT                                  PICTURE S9(18)
                                              BINARY.
***********************************************************
* Attribute:    ulonglong
* Mapped name:  ulonglong
* Type:         unsigned long long (read/write)
***********************************************************
01 EXAMPLE-ULONGLONG-ARGS.
   03 RESULT                                  PICTURE 9(18)
                                              BINARY.
***********************************************************
* Constants in example:
***********************************************************
01 EXAMPLE-CONSTS.
   03 MY-SHORT                                PICTURE S9(05)
                                              BINARY VALUE 24.
   03 MY-LONG                                 PICTURE S9(10)
                                              BINARY VALUE 9999.
```

Mapping for Boolean Type

Overview

This section describes how booleans are mapped to COBOL.

IDL-to-COBOL mapping for booleans

An IDL boolean type maps to a COBOL `PIC 9(01)` integer value and has two COBOL conditions defined, as follows:

- A label *`idl-identifier`*`-FALSE` with a `0` value.
- A label *`idl-identifier`*`-TRUE` with a `1` value.

Note: Earlier versions of the COBOL compiler did not support the non-COBOL85 `>>CONSTANT` construct. This is specified for the mapping of constant boolean values. Responsibility is passed to the Orbix IDL compiler to propagate constant values. In this case, the following mapping approach that uses `Level 88` items has been chosen:

Example

The example can be broken down as follows:

1. Consider the following IDL, which is contained in an IDL member called `EXAM1`:

```
// IDL
interface example {
    attribute boolean full;
    boolean myop(in boolean myboolean);
}
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following COBOL in the `EXAM1` copybook:

```
*************************************************************
* Attribute:    full
* Mapped name:  full
* Type:        boolean (read/write)
************************************************************
01 EXAMPLE-FULL-ARGS.
   03 RESULT                            PICTURE 9(01) BINARY.
      88 RESULT-FALSE                     VALUE 0.
      88 RESULT-TRUE                      VALUE 1.
************************************************************
* Operation:      myop
* Mapped name:    myop
* Arguments:      <in> boolean myboolean
* Returns:        boolean
* User Exceptions: none
*************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYBOOLEAN                         PICTURE 9(01) BINARY.
      88 MYBOOLEAN-FALSE                  VALUE 0.
      88 MYBOOLEAN-TRUE                   VALUE 1.
   03 RESULT                            PICTURE 9(01) BINARY.
      88 RESULT-FALSE                     VALUE 0.
      88 RESULT-TRUE                      VALUE 1.
01 EXAMPLE-OPERATION                      PICTURE X(26).
   88 EXAMPLE-GET-FULL                    VALUE
      "_get_full:IDL:example:1.0".
   88 EXAMPLE-SET-FULL                    VALUE
      "_set_full:IDL:example:1.0".
   88 EXAMPLE-MYOP                        VALUE
      "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH              PICTURE 9(09) BINARY
                                          VALUE 26.
```

3. The preceding code can be used as follows:

```
IF RESULT-TRUE OF RESULT OF EXAMPLE-FULL-ARGS THEN
    SET EXAMPLE-SET-FULL TO TRUE
    ELSE
    SET EXAMPLE-GET-FULL TO TRUE
END-IF
CALL "ORBEXEC" USING SERVER-OBJ
    EXAMPLE-OPERATION
    EXAMPLE-FULL-ARGS
    EXAM1-USER-EXCEPTIONS
```

Mapping for Enum Type

Overview

This section describes how enums are mapped to COBOL.

IDL-to-COBOL mapping for enums

An IDL enum type maps to a COBOL `PIC 9(10) BINARY` type. The COBOL mapping for an enum is an unsigned integer capable of representing 2**32 enumerations (that is, 2^{32-1} enumerations). Because IDL does not allow you to set ordinal values for enums, each identifier in a mapped enum has a COBOL condition defined with its own appropriate integer value, based on the rule that integer values are incrementing and start at 0. Each identifier is a level `88` entry.

Example

The example can be broken down as follows:

1. Consider the following IDL, which is contained in an IDL member called `EXAM2`:

```
// IDL
interface example {
    enum temp {cold, warm, hot };
    attribute temp attr1;
    temp myop(in temp myenum);
}
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following COBOL in the `EXAM2` copybook:

```
*************************************************************
* Attribute:    attr1
* Mapped name:  attr1
* Type:        temp (read/write)
*************************************************************
01 EXAMPLE-ATTR1-ARGS.
   03 RESULT                             PICTURE 9(10) BINARY.
      88 COLD                              VALUE 0.
      88 WARM                              VALUE 1.
      88 HOT                               VALUE 2.
*************************************************************
* Operation:      myop
* Mapped name:    myop
* Arguments:      <in> temp myenum
* Returns:        temp
* User Exceptions: none
*************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYENUM                             PICTURE 9(10) BINARY.
      88 COLD                              VALUE 0.
      88 WARM                              VALUE 1.
      88 HOT                               VALUE 2.
   03 RESULT                             PICTURE 9(10) BINARY.
      88 COLD                              VALUE 0.
      88 WARM                              VALUE 1.
      88 HOT                               VALUE 2.
```

3. The preceding code can be used as follows:

```
EVALUATE TRUE
    WHEN COLD OF EXAMPLE-ATTR1-ARGS
    …
    WHEN WARM OF EXAMPLE-ATTR1-ARGS
    …
    WHEN HOT OF EXAMPLE-ATTR1-ARGS
    …
END-EVALUATE
```

Mapping for Char Type

Overview

This section describes how char types are mapped to COBOL.

IDL-to-COBOL mapping for char types

Char data values that are passed between machines with different character encoding methods (for example, ASCII, EBCDIC, and so on) are translated by the ORB.

Example

The example can be broken down as follows:

1. Consider the following IDL, which is contained in an IDL member called `EXAM3`:

```
// IDL
interface example {
    attribute char achar;
    char myop(in char mychar);
}
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following COBOL in the `EXAM3` copybook:

```
************************************************************
* Attribute:    achar
* Mapped name:  achar
* Type:         char (read/write)
************************************************************
01 EXAMPLE-ACHAR-ARGS.
   03 RESULT                                 PICTURE X(01).
************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       <in> char mychar
* Returns:         char
* User Exceptions: none
************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYCHAR                                 PICTURE X(01).
   03 RESULT                                 PICTURE X(01).
```

Mapping for Octet Type

Overview

This section describes how octet types are mapped to COBOL.

IDL-to-COBOL mapping for octet types

The octet type refers to binary character data. The ORB does not translate any octet data, even if the remote system has a different character set than the local system (for example ASCII and EBCDIC). You should take special care in selecting the appropriate IDL type when representing text data (that is, a string) as opposed to opaque binary data (that is, an octet).

Example

The example can be broken down as follows:

1. Consider the following IDL, which is contained in an IDL member called `EXAM4`:

```
interface example {
    attribute octet aoctet;
    octet myop(in octet myoctet);
}
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following COBOL in the `EXAM4` copybook:

```
************************************************************
* Attribute:    aoctet
* Mapped name:  aoctet
* Type:         octet (read/write)
************************************************************
01 EXAMPLE-AOCTET-ARGS.
   03 RESULT                                PICTURE X(01).
************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       <in> char myoctet
* Returns:         octet
* User Exceptions: none
************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYOCTET                               PICTURE X(01).
   03 RESULT                                PICTURE X(01).
```

Mapping for String Types

Overview

This section describes how string types are mapped to COBOL. First, it describes the various string types that are available.

Bounded and unbounded strings

Strings can be bounded or unbounded. Bounded strings are of a specified size, while unbounded strings have no specified size. For example:

```
//IDL
string<8>  a_bounded_string
string     an_unbounded_string
```

Bounded and unbounded strings are represented differently in COBOL.

Incoming bounded strings

Incoming strings are passed as `IN` or `INOUT` values by the `COAGET` function into the COBOL operation parameter buffer at the start of a COBOL operation.

An incoming bounded string is represented by a COBOL `PIC X(`*n*`)` data item, where *n* is the bounded length of the string. For example:

1. Consider the following IDL:

```
interface example {
    typedef string<10> boundedstr;
    attribute boundedstr aboundedstr;
    boundedstr myop(in boundedstr myboundedstr);
};
```

2. The preceding IDL maps to the following COBOL:

```
***********************************************************
* Attribute:    aboundedstr
* Mapped name:  aboundedstr
* Type:        example/boundedstr (read/write)
***********************************************************
01 EXAMPLE-ABOUNDEDSTR-ARGS.
   03 RESULT                                PICTURE X(10).
***********************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:      <in> example/boundedstr myboundedstr
* Returns:         example/boundedstr
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYBOUNDEDSTR                          PICTURE X(10).
   03 RESULT                                PICTURE X(10).
***********************************************************
```

If the string that is passed is too big for the buffer, the string is truncated. If the string is not big enough to fill the buffer, the remainder of the COBOL string is filled with spaces.

Outgoing bounded strings

Outgoing strings are copied as `INOUT`, `OUT`, or `RESULT` values by the `COAPUT` function from the complete COBOL operation parameter buffer that is passed to it at the end of a COBOL operation.

An outgoing bounded string has trailing spaces removed, and all characters up to the bounded length (or the first null) are passed via `COAPUT`. If a null is encountered before the bounded length, only those characters preceding the null are passed. The remaining characters are not passed.

Incoming unbounded strings

Incoming strings are passed as `IN` or `INOUT` values by the `COAGET` function into the COBOL operation parameter buffer at the start of a COBOL operation.

An incoming unbounded string is represented as a `USAGE IS POINTER` data item. For example:

1. Consider the following IDL:

```
interface example {
    typedef string unboundedstr;
    attribute unboundedstr aunboundedstr;
    unboundedstr myop(in unboundedstr myunboundedstr);
};
```

2. The preceding IDL maps to the following COBOL:

```
*************************************************************
* Attribute:    aunboundedstr
* Mapped name:  aunboundedstr
* Type:        example/unboundedstr (read/write)
*************************************************************
01 EXAMPLE-AUNBOUNDEDSTR-ARGS.
   03 RESULT                              POINTER VALUE NULL.
*************************************************************
* Operation:      myop
* Mapped name:    myop
* Arguments:     <in> example/unboundedstr munyboundedstr
* Returns:        example/unboundedstr
* User Exceptions: none
*************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MUNYBOUNDEDSTR                      POINTER VALUE NULL.
   03 RESULT                              POINTER VALUE NULL.
```

3. A pointer is supplied which refers to an area of memory containing the string data. This string is not directly accessible. You must call the `STRGET` function to copy the data into a COBOL `PIC X(n)` structure. For example:

```
* This is the supplied COBOL unbounded string pointer

01 NAME                    USAGE IS POINTER

* This is the COBOL representation of the string

01 SUPPLIER-NAME           PICTURE X(64).
01 SUPPLIER-NAME-LEN       PICTURE 9(10) BINARY  VALUE 64.

* This STRGET call copies the characters in the NAME
* to the SUPPLIER-NAME

CALL "STRGET"              USING NAME
                                 SUPPLIER-NAME-LEN
                                 SUPPLIER-NAME.
```

In the preceding example, the number of characters copied depends on the value specified for `SUPPLIER-NAME-LEN`. This must be a valid positive integer (that is, greater than zero); otherwise, a runtime error occurs. If the value specified for `SUPPLIER-NAME` is shorter than that for `SUPPLIER-NAME-LEN`, the string is still copied to `SUPPLIER-NAME`, but it obviously cannot contain the complete string.

Outgoing unbounded strings

Outgoing strings are copied as `INOUT`, `OUT`, or `RESULT` values by the `COAPUT` function from the complete COBOL operation parameter buffer that is passed to it at the end of a COBOL operation.

A valid outgoing unbounded string must be supplied by the implementation of an operation. This can be either a pointer that was obtained by an `IN` or `INOUT` parameter, or a string constructed by using the `STRSET` function. For example:

```
* This is the COBOL representation of the string containing a
* value that we want to pass back to the client using COAPUT
* via an unbounded pointer string.                            */

 01 NOTES                           PICTURE X(160).
 01 NOTES-LEN                       PICTURE 9(10) BINARY
                                    VALUE 160.

* This is the unbounded pointer string

 01 CUST-NOTES                      USAGE IS POINTER.

* This STRSET call creates an unbounded string called CUST-NOTES
* to which it copies NOTES-LEN characters from character string
* NOTES

CALL "STRSET"                       USING CUST-NOTES
                                          NOTES-LEN
                                          NOTES.
```

Trailing spaces are removed from the constructed string. If trailing spaces are required, you can use the `STRSETP` function, with the same argument signature, to copy the specified number of characters, including trailing spaces.

Mapping for Wide String Types

Overview

This section describes how wide string types are mapped to COBOL.

IDL-to-COBOL mapping for wide strings

The mapping for the `wstring` type is similar to the mapping for strings, but it requires DBCS support from the IBM COBOL compiler. Earlier versions of the COBOL compiler did not have DBCS support.

A `PICTURE G` (instead of a `PICTURE X`) data item represents the COBOL data item. Instead of calling `STRGET` and `STRSET` to access unbounded strings, the auxiliary functions `WSTRGET` and `WSTRSET` should be used. The argument signatures for these functions are equivalent to their string counterparts.

Mapping for Fixed Type

Overview

This section describes how fixed types are mapped to COBOL.

IDL-to-COBOL mapping for fixed types

The IDL fixed type maps directly to COBOL packed decimal data with the appropriate number of digits and decimal places (if any).

Note: All fixed types must be declared in IDL with `typedef`.

The fixed-point decimal data type

The fixed-point decimal data type is used to express in exact terms numeric values that consist of both an integer and a fixed-length decimal fraction part. The fixed-point decimal data type has the format `<d,s>`.

Examples of the fixed-point decimal data type

You might use it to represent a monetary value in dollars. For example:

```
typedef fixed<9,2> net_worth; // up to $9,999,999.99, accurate to
                              // one cent.
typedef fixed<9,4> exchange_rate; // accurate to 1/10000 unit.
typedef fixed<9,0> annual_revenue; // in millions
typedef fixed<3,6> wrong; // this is invalid.
```

Explanation of the fixed-point decimal data type

The format of the fixed-point decimal data type can be explained as follows:

1. The first number within the angle brackets is the total number of digits of precision.
2. The second number is the scale (that is, the position of the decimal point relative to the digits).

   A positive scale represents a fractional quantity with that number of digits after the decimal point. A zero scale represents an integral value. A negative scale is allowed, and it denotes a number with units in positive powers of ten (that is, hundreds, millions, and so on).

Example of IDL-to-COBOL mapping for fixed types

The example can be broken down as follows:

1. Consider the following IDL:

```
//IDL
interface example
{
    typedef fixed<10,0> type_revenue;
    attribute type_revenue revenue;
    typedef fixed<6,4> type_precise;
    attribute type_precise precise;
    type_precise myop(in type_revenue myfixed);
    typedef fixed<6,-4> type_millions;
    attribute type_millions millions;
};
```

2. The preceding IDL maps to the following COBOL:

Example 14: *COBOL Example for Fixed Type (Sheet 1 of 2)*

```
***********************************************************
* Attribute:    revenue
* Mapped name:  revenue
* Type:         example/type_revenue (read/write)
***********************************************************
01 EXAMPLE-REVENUE-ARGS.
   03 RESULT                        PICTURE S9(10)
                                    PACKED-DECIMAL.
***********************************************************
* Attribute:    precise
* Mapped name:  precise
* Type:         example/type_precise (read/write)
***********************************************************
01 EXAMPLE-PRECISE-ARGS.
   03 RESULT                        PICTURE S9(2)V9(4)
                                    PACKED-DECIMAL.
***********************************************************
* Attribute:    millions
* Mapped name:  millions
* Type:         example/type_millions (read/write)
***********************************************************
01 EXAMPLE-MILLIONS-ARGS.
   03 RESULT                        PICTURE S9(6)P(4)
                                    PACKED-DECIMAL.
**********************************************************
* Operation:       myop
```

Example 14: *COBOL Example for Fixed Type (Sheet 2 of 2)*

```
* Mapped name:     myop
* Arguments:       <in> example/type_revenue myfixed
* Returns:         example/type_precise
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYFIXED                       PICTURE S9(10)
                                    PACKED-DECIMAL.
   03 RESULT                        PICTURE S9(2)V9(4)
                                    PACKED-DECIMAL.
```

Limitations in size of COBOL numeric data items

The IDL fixed type specifies support for up to 31 digits. To enable Orbix Mainframe to support COBOL data items that can be up to 31 digits, both of the following apply:

- The `-E` COBOL plug-in argument to the Orbix IDL compiler must be specified when running the Orbix IDL compiler, to allow for generation of COBOL data items that can be up to 31 digits.
- The `ARITH(EXTEND)` option must be specified when running the COBOL compiler, to ensure that the maximum number of digits that can be supported for packed-decimal data items is 31 rather than 18.

If you do not specify the `-E` COBOL plug-in argument with the Orbix IDL compiler, and the IDL fixed type definition specifies more than 18 digits, the generated data item is restricted to 18 digits. In this case, truncation of the excess most-significant digits occurs when the item is passed to COBOL, and passing data from COBOL to a fixed type with greater than 18 digits results in zero-filling of the excess most-significant digits. Additionally, if you do enable the Orbix IDL compiler to generate data items over 18 digits long, but you do not subsequently specify the `ARITH(EXTEND)` option with the COBOL compiler, the COBOL compile will result in errors.

These restrictions are not relevant if you specify both the `-E` COBOL plug-in argument with the Orbix IDL compiler and the `ARITH(EXTEND)` option with the COBOL compiler.

Example of mappings with and without limitations

For example, consider the following IDL:

```
// IDL
interface example
{
    typedef fixed<25,0> lots_of_digits;
    attribute lots_of_digits large_value;

    typedef fixed<25,8> lots_of_digits_and_prec;
    attribute lots_of_digits_and_prec large_value_prec;
};
```

When you specify the `-E` COBOL plug-in argument with the Orbix IDL compiler, the following COBOL is generated based on the preceding IDL:

```
***********************************************************
* Attribute:    large_value
* Mapped name:  large_value
* Type:         example/lots_of_digits (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-ARGS.
   03 RESULT                              PICTURE S9(25)
                                          PACKED-DECIMAL.
***********************************************************
* Attribute:    large_value_prec
* Mapped name:  large_value_prec
* Type:         example/lots_of_digits_and_prec (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-PREC-ARGS.
   03 RESULT                              PICTURE S9(17)V9(8)
                                          PACKED-DECIMAL.
```

Alternatively, if you do not specify the `-E` COBOL plug-in argument with the Orbix IDL compiler, it issues a warning message and generates the following COBOL based on the preceding IDL:

```
***********************************************************
* Attribute:    large_value
* Mapped name:  large_value
* Type:         example/lots_of_digits (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-ARGS.
   03 RESULT                              PICTURE S9(18)
                                          PACKED-DECIMAL.
***********************************************************
* Attribute:    large_value_prec
* Mapped name:  large_value_prec
* Type:         example/lots_of_digits_and_prec (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-PREC-ARGS.
   03 RESULT                              PICTURE S9(17)V9(1)
                                          PACKED-DECIMAL.
```

Mapping for Struct Type

Overview

This section describes how struct types are mapped to COBOL.

IDL-to-COBOL mapping for struct types

An IDL struct definition maps directly to COBOL group items.

Example of IDL-to-COBOL mapping for struct types

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   struct a_structure
   {
       long       member1;
       short      member2;
       boolean    member3;
       string<10> member4;
   };
   typedef a_structure type_struct;
   attribute type_struct astruct;
   type_struct myop(in type_struct mystruct);
};
```

2. The preceding IDL maps to the following COBOL:

```
***********************************************************
* Attribute:    astruct
* Mapped name:  astruct
* Type:       example/type_struct (read/write)
***********************************************************
01 EXAMPLE-ASTRUCT-ARGS.
   03 RESULT.
      05 MEMBER1                        PICTURE S9(10) BINARY.
      05 MEMBER2                        PICTURE S9(05) BINARY.
      05 MEMBER3                        PICTURE 9(01) BINARY.
         88 MEMBER3-FALSE                  VALUE 0.
         88 MEMBER3-TRUE                   VALUE 1.
      05 MEMBER4                        PICTURE X(10).
***********************************************************
* Operation:      myop
* Mapped name:    myop
* Arguments:      <in> example/type_struct mystruct
* Returns:        example/type_struct
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYSTRUCT.
      05 MEMBER1                        PICTURE S9(10) BINARY.
      05 MEMBER2                        PICTURE S9(05) BINARY.
      05 MEMBER3                        PICTURE 9(01) BINARY.
         88 MEMBER3-FALSE                  VALUE 0.
         88 MEMBER3-TRUE                   VALUE 1.
      05 MEMBER4                        PICTURE X(10).
   03 RESULT.
      05 MEMBER1                        PICTURE S9(10) BINARY.
      05 MEMBER2                        PICTURE S9(05) BINARY.
      05 MEMBER3                        PICTURE 9(01) BINARY.
         88 MEMBER3-FALSE                  VALUE 0.
         88 MEMBER3-TRUE                   VALUE 1.
      05 MEMBER4                        PICTURE X(10).
```

Mapping for Union Type

Overview

This section describes how union types are mapped to COBOL.

IDL-to-COBOL mapping for union types

An IDL union definition maps directly to COBOL group items with the `REDEFINES` clause.

Simple example of IDL-to-COBOL mapping for union types

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   union a_union switch(long)
   {
      case 1: char case_1;
      case 3: long case_3;
      default: string case_def;
   };
   typedef a_union type_union;
   attribute type_union aunion;
   type_union myop(in type_union myunion);
};
```

2. The preceding IDL maps to the following COBOL:

Example 15: *COBOL Example for Union Type (Sheet 1 of 2)*

```
*************************************************************
* Attribute:    aunion
* Mapped name:  aunion
* Type:         example/type_union (read/write)
*************************************************************
01 EXAMPLE-AUNION-ARGS.
   03 RESULT.
      05 D                              PICTURE S9(10) BINARY.
      05 U.
         07 FILLER                      PICTURE X(08)
                                        VALUE LOW-VALUES.
      05 FILLER REDEFINES U.
```

Example 15: *COBOL Example for Union Type (Sheet 2 of 2)*

```
          07 CASE-1                          PICTURE X(01).
       05 FILLER REDEFINES U.
          07 CASE-3                          PICTURE S9(10) BINARY.
       05 FILLER REDEFINES U.
          07 CASE-DEF                        POINTER.
***********************************************************
* Operation:        myop
* Mapped name:      myop
* Arguments:        <in> example/type_union myunion
* Returns:          example/type_union
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYUNION.
      05 D                                   PICTURE S9(10) BINARY.
      05 U.
         07 FILLER                           PICTURE X(08)
                                             VALUE LOW-VALUES.
      05 FILLER REDEFINES U.
         07 CASE-1                           PICTURE X(01).
      05 FILLER REDEFINES U.
         07 CASE-3                           PICTURE S9(10) BINARY.
      05 FILLER REDEFINES U.
         07 CASE-DEF                         POINTER.
   03 RESULT.
      05 D                                   PICTURE S9(10) BINARY.
      05 U.
         07 FILLER                           PICTURE X(08)
                                             VALUE LOW-VALUES.
      05 FILLER REDEFINES U.
         07 CASE-1                           PICTURE X(01).
      05 FILLER REDEFINES U.
         07 CASE-3                           PICTURE S9(10) BINARY.
      05 FILLER REDEFINES U.
         07 CASE-DEF                         POINTER.
```

COBOL rules for mapped IDL unions

The following rules apply in COBOL for union types mapped from IDL:

1. The union discriminator in the group item is always referred to as `D`.
2. The union items are contained within the group item referred to as `U`.

3. Reference to union elements is made through the `EVALUATE` statement to test the discriminator.

Note: If `D` and `U` are used as IDL identifiers, they are treated as reserved words. This means that they are prefixed with `IDL-` in the generated COBOL (for example, the IDL identifier `d` maps to the COBOL identifier `IDL-D`).

Example of COBOL rules for mapped IDL unions

The following code shows the COBOL rules for mapped IDL unions in effect:

```
EVALUATE D OF RESULT OF EXAMPLE-AUNION-ARGS
WHEN 1
  DISPLAY "its a character value = " CASE-1 OF U OF
   EXAMPLE-AUNION-ARGS
…
WHEN 3
   DISPLAY "its a long value =  " CASE-3 OF U OF
   EXAMPLE-AUNION-ARGS
WHEN OTHER
   DISPLAY "its an unbounded string "
* use strget to retrieve value
END-EVALUATE
```

More complex example

The following provides a more complex example of the IDL-to-COBOL mapping rules for union types. The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
   union a_union switch(long)
   {
      case 1: char case_1;
      case 3: long case_3;
      default: string case_def;
   };
   typedef a_union type_union;

   union a_nest_union switch(char)
   {
      case 'a': char case_a;
      case 'b': long case_b;
      case 'c': type_union case_c;
      default: string case_other;
   };
    typedef a_nest_union type_nest_union;

   attribute type_nest_union anestunion;

};
```

2. The preceding IDL maps to the following COBOL:

```
************************************************************
* Attribute:    anestunion
* Mapped name:  anestunion
* Type:        example/type_nest_union (read/write)
************************************************************
01 EXAMPLE-ANESTUNION-ARGS.
   03 RESULT.
      05 D                                PICTURE X(01).
      05 U.
         07 FILLER                        PICTURE X(16)
                                          VALUE LOW-VALUES.
      05 FILLER REDEFINES U.
         07 CASE-A                        PICTURE X(01).
      05 FILLER REDEFINES U.
        07 CASE-B                      PICTURE S9(10) BINARY.
         05 FILLER REDEFINES U.
            07 CASE-C.
              09 D-1                   PICTURE S9(10) BINARY.
               09 U-1.
                  11 FILLER               PICTURE X(08).
               09 FILLER REDEFINES U-1.
                  11 CASE-1               PICTURE X(01).
               09 FILLER REDEFINES U-1.
                 11 CASE-3             PICTURE S9(10) BINARY.
               09 FILLER REDEFINES U-1.
                  11 CASE-DEF             POINTER.
         05 FILLER REDEFINES U.
             07 CASE-OTHER                POINTER.
```

Mapping for Sequence Types

Overview

This section describes how sequence types are mapped to COBOL. First, it describes the various sequence types that are available.

Bounded and unbounded sequences

A sequence can be either bounded or unbounded. A bounded sequence is of a specified size, while an unbounded sequence has no specified size. For example:

```
// IDL
typedef sequence<long,10> bounded seq
attribute boundedseq seq1
typedef sequence<long> unboundedseq
attribute unboundedseq seq2
```

Bounded and unbounded sequences are represented differently in COBOL. However, regardless of whether a sequence is bounded or unbounded, a supporting group item is always generated by the Orbix IDL compiler, to provide some information about the sequence, such as the maximum length, the length of the sequence in elements, and the contents of the sequence (in the case of the unbounded sequence). After a sequence is initialized, the sequence length is equal to zero. The first element of a sequence is referenced as element `1`.

Incoming and outgoing sequences

A sequence that is being passed as an incoming parameter to a COBOL operation is passed as an `IN` or `INOUT` value by the `COAGET` function into the operation parameter buffer at the start of the operation.

A sequence that is being passed as an outgoing parameter or result from a COBOL operation is copied as an `INOUT`, `OUT`, or `RESULT` value by the `COAPUT` function from the complete operation parameter buffer that is passed to it at the end of the operation.

IDL-to-COBOL mapping for bounded sequences

A bounded sequence is represented by a COBOL `OCCURS` clause and a supporting group item. For example:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long,10> boundedseq;
   attribute boundedseq aseq;
   boundedseq myop(in boundedseq myseq);
};
```

2. The preceding IDL maps to the following COBOL:

Example 16: *COBOL Example for Bounded Sequences (Sheet 1 of 2)*

```
***************************************************************
* Attribute:    aseq
* Mapped name:  aseq
* Type:         example/boundedseq (read/write)
***************************************************************
01 EXAMPLE-ASEQ-ARGS.
   03 RESULT-1                              OCCURS 10 TIMES.
     05 RESULT                            PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM                   PICTURE 9(09) BINARY
                                            VALUE 10.
      05 SEQUENCE-LENGTH                    PICTURE 9(09) BINARY
                                            VALUE 0.
      05 SEQUENCE-BUFFER                    POINTER VALUE NULL.
      05 SEQUENCE-TYPE                      POINTER VALUE NULL.
****************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       <in> example/boundedseq myseq
* Returns:         example/boundedseq
* User Exceptions: none
****************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYSEQ-1                               OCCURS 10 TIMES.
     05 MYSEQ                             PICTURE S9(10) BINARY.
   03 MYSEQ-SEQUENCE.
      05 SEQUENCE-MAXIMUM                   PICTURE 9(09) BINARY
                                            VALUE 10.
      05 SEQUENCE-LENGTH                    PICTURE 9(09) BINARY
```

Example 16: *COBOL Example for Bounded Sequences (Sheet 2 of 2)*

```
                                              VALUE 0.
       05 SEQUENCE-BUFFER                     POINTER VALUE NULL.
       05 SEQUENCE-TYPE                       POINTER VALUE NULL.
    03 RESULT-1                               OCCURS 10 TIMES.
       05 RESULT                             PICTURE S9(10) BINARY.
    03 RESULT-SEQUENCE.
       05 SEQUENCE-MAXIMUM                    PICTURE 9(09) BINARY
                                              VALUE 10.
       05 SEQUENCE-LENGTH                     PICTURE 9(09) BINARY
                                              VALUE 0.
       05 SEQUENCE-BUFFER                     POINTER VALUE NULL.
       05 SEQUENCE-TYPE                       POINTER VALUE NULL.
```

All elements of a bounded sequence can be accessed directly. Unpredictable results can occur if you access a sequence element that is past the current length but within the maximum number of elements for the sequence.

IDL-to-COBOL mapping for unbounded sequences

An unbounded sequence cannot map to a COBOL `OCCURS` clause, because the size of the sequence is not known. In this case, a group item is created to hold one element of the sequence, and a supporting group item is also created. The supporting group item contains the following data definitions:

```
SEQUENCE-MAXIMUM                   PICTURE 9(09) BINARY VALUE 0.
SEQUENCE-LENGTH                    PICTURE 9(09) BINARY VALUE 0.
SEQUENCE-BUFFER                     POINTER VALUE NULL.
SEQUENCE-TYPE                       POINTER VALUE NULL.
```

The preceding data definitions can be explained as follows:

`SEQUENCE-MAXIMUM`	The maximum number of elements for the sequence.
`SEQUENCE-LENGTH`	The number of elements currently populated in the sequence.
`SEQUENCE-BUFFER`	The actual data associated with each sequence element.
`SEQUENCE-TYPE`	The typecode associated with the sequence.

The elements of a sequence are not directly accessible. Instead, you can call `SEQSET` to copy the supplied data into the requested element of the sequence, and `SEQGET` to provide access to a specific element of the sequence. See “SEQGET” on page 494 and “SEQSET” on page 497 for more details of these. Also, because an unbounded sequence is a dynamic type, memory must be allocated for it at runtime, by calling the `SEQALLOC` function. See "SEQALLOC" on page 482 for more details.

Example of unbounded sequences mapping

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long> unboundedseq;
   attribute unboundedseq aseq;
   unboundedseq myop(in unboundedseq myseq);
};
```

2. The preceding IDL maps to the following COBOL:

Example 17: *COBOL Example for Unbounded Sequences (Sheet 1 of 2)*

```
****************************************************************
* Attribute:    aseq
* Mapped name:  aseq
* Type:         example/unboundedseq (read/write)
****************************************************************
01 EXAMPLE-ASEQ-ARGS.
   03 RESULT-1.
     05 RESULT                             PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM                    PICTURE 9(09) BINARY
                                               VALUE 0.
      05 SEQUENCE-LENGTH                     PICTURE 9(09) BINARY
                                               VALUE 0.
      05 SEQUENCE-BUFFER                       POINTER
                                               VALUE NULL.
      05 SEQUENCE-TYPE                         POINTER
                                               VALUE NULL.
*****************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       <in> example/unboundedseq myseq
* Returns:         example/unboundedseq
* User Exceptions: none
*****************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYSEQ-1.
```

Example 17: *COBOL Example for Unbounded Sequences (Sheet 2 of 2)*

```
    05 MYSEQ                              PICTURE S9(10) BINARY.
  03 MYSEQ-SEQUENCE.
    05 SEQUENCE-MAXIMUM                    PICTURE 9(09) BINARY
                                             VALUE 0.
    05 SEQUENCE-LENGTH                     PICTURE 9(09) BINARY
                                             VALUE 0.
    05 SEQUENCE-BUFFER                       POINTER
                                             VALUE NULL.
    05 SEQUENCE-TYPE                         POINTER
                                             VALUE NULL.
  03 RESULT-1.
    05 RESULT                             PICTURE S9(10) BINARY.

  03 RESULT-SEQUENCE.
    05 SEQUENCE-MAXIMUM                    PICTURE 9(09) BINARY
                                             VALUE 0.
    05 SEQUENCE-LENGTH                     PICTURE 9(09) BINARY
                                             VALUE 0.
    05 SEQUENCE-BUFFER                       POINTER
                                             VALUE NULL.
    05 SEQUENCE-TYPE                         POINTER
                                             VALUE NULL.
```

Initial storage is assigned to the sequence via `SEQALLOC`. Elements of an unbounded sequence are not directly accessible. You can use `SEQGET` and `SEQSET` to access specific elements in the sequence.

Note: For details and examples of how to use the APIs pertaining to sequences, see "SEQALLOC" on page 482, "SEQDUP" on page 486, "SEQFREE" on page 491, "SEQGET" on page 494, and "SEQSET" on page 497.

Mapping for Array Type

Overview

This section describes how arrays are mapped to COBOL.

IDL-to-COBOL mapping for arrays

An IDL array definition maps directly to the COBOL `OCCURS` clause. Each element of the array is directly accessible.

> **Note:** A COBOL `WORKING-STORAGE` numeric data item must be defined and used as the subscript to reference array data (that is, table data). This subscript value starts at `1` in COBOL, as opposed to starting at `0` in C or C++.

Example of IDL-to-COBOL mapping for arrays

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef long long_array[2][5];
   attribute long_array aarray;
   long_array myop(in long_array myarray);
};
```

2. The preceding IDL maps to the following COBOL:

```
************************************************************
* Attribute:    aarray
* Mapped name:  aarray
* Type:        example/long_array (read/write)
************************************************************
01 EXAMPLE-AARRAY-ARGS.
   03 RESULT-1                           OCCURS 2 TIMES.
      05 RESULT-2                        OCCURS 5 TIMES.
        07 RESULT                     PICTURE S9(10) BINARY.
************************************************************
* Operation:      myop
* Mapped name:    myop
* Arguments:      <in> example/long_array myarray
* Returns:        example/long_array
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYARRAY-1                          OCCURS 2 TIMES.
      05 MYARRAY-2                       OCCURS 5 TIMES.
        07 MYARRAY                    PICTURE S9(10) BINARY.
   03 RESULT-1                           OCCURS 2 TIMES.
      05 RESULT-2                        OCCURS 5 TIMES.
        07 RESULT                     PICTURE S9(10) BINARY.
```

Mapping for the Any Type

Overview

This section describes how anys are mapped to COBOL.

IDL-to-COBOL mapping for anys

The IDL `any` type maps to a COBOL pointer.

Example of IDL-to-COBOL mapping for anys

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef any a_any;
   attribute a_any aany;
   a_any myop(in a_any myany);
};
```

2. The preceding IDL maps to the following COBOL:

```
*************************************************************
* Attribute:    aany
* Mapped name:  aany
* Type:         example/a_any (read/write)
*************************************************************
01 EXAMPLE-AANY-ARGS.
   03 RESULT                                  POINTER
                                              VALUE NULL.
*************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       <in> example/a_any myany
* Returns:         example/a_any
* User Exceptions: none
*************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MYANY                                   POINTER
                                              VALUE NULL.
   03 RESULT                                  POINTER
                                              VALUE NULL.
```

Accessing and changing contents of an any

The contents of the `any` type cannot be accessed directly. Instead you can use the `ANYGET` function to extract data from an `any` type, and use the `ANYSET` function to insert data into an `any` type.

Before you call `ANYGET`, call `TYPEGET` to retrieve the type of the `any` into the level `01` data name that is generated by the Orbix IDL compiler. This data item is large enough to hold the largest type name defined in the interface. Similarly, before you call `ANYSET`, call `TYPESET` to set the type of the `any`.

Refer to "ANYGET" on page 416 and "TYPEGET" on page 520 for details and an example of how to access the contents of an `any`. Refer to "ANYSET" on page 418 and "TYPESET" on page 522 for details and an example of how to change the contents of an `any`.

Mapping for User Exception Type

Overview

This section describes how user exceptions are mapped to COBOL.

IDL-to-COBOL mapping for exceptions

An IDL exception maps to the following in COBOL:

- A level `01` group item that contains the definitions for all the user exceptions defined in the IDL. This group item is defined in COBOL as follows:

  ```
  01 idlmembername-USER-EXCEPTIONS.
  ```

  The group item contains the following level `03` items:

  - An `EXCEPTION-ID` string that contains a textual description of the exception.
  - A `D` data name that specifies the ordinal number of the current exception. Within this each user exception has a level `88` data name generated with its corresponding ordinal value.
  - A `U` data name.
  - A data name for each user exception, which redefines `U`. Within each of these data names are level `05` items that are the COBOL-equivalent user exception definitions for each user exception, based on the standard IDL-to-COBOL mapping rules.
- A level `01` data name with an `EX-`*`FQN-userexceptionname`* format, which has a string literal that uniquely identifies the user exception.
- A corresponding level 01 data name with an `EX-`*`FQN-userexceptionname`*`-LENGTH` format, which has a value specifying the length of the string literal.

Note: If `D` and `U` are used as IDL identifiers, they are treated as reserved words. This means that they are prefixed with `IDL-` in the generated COBOL. For example, the IDL identifier, `d`, maps to the COBOL identifier, `IDL-D`.

Example of IDL-to-COBOL mapping for exceptions

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example {
    exception bad {
        long       value1;
        string<32> reason;
    };

    exception worse {
        short      value2;
        string<16> errorcode;
        string<32> reason;
    };

    void addName(in string name) raises(bad,worse);
};
```

2. The preceding IDL maps to the following COBOL:

```
***********************************************************
* Operation:        AddName
* Mapped name:      AddName
* Arguments:        <in> string name
* Returns:          void
* User Exceptions: example/bad
*                  example/worse
***********************************************************
01 EXAMPLE-ADDNAME-ARGS.
   03 NAME                                    POINTER
                                              VALUE NULL.
***********************************************************
* User exception block
***********************************************************
01 EX-EXAMPLE-BAD                 PICTURE X(19)
                                 VALUE "IDL:example/bad:1.0".
01 EX-EXAMPLE-BAD-LENGTH          PICTURE 9(09) BINARY
                                  VALUE 19.
01 EX-EXAMPLE-WORSE               PICTURE X(21)
                               VALUE "IDL:example/worse:1.0".
01 EX-EXAMPLE-WORSE-LENGTH        PICTURE 9(09) BINARY
                                  VALUE 21.
01 EXAM16-USER-EXCEPTIONS.
   03 EXCEPTION-ID                PICTURE
                                  VALUE NULL.
   03 D                           PICTURE 9(10) BINARY
                                  VALUE 0.
      88 D-NO-USEREXCEPTION       VALUE 0.
      88 D-EXAMPLE-BAD            VALUE 1.
      88 D-EXAMPLE-WORSE          VALUE 2.
   03 U                           PICTURE X(52)
                                  VALUE LOW-VALUES.
   03 EXCEPTION-EXAMPLE-BAD REDEFINES U.
      05 VALUE1                   PICTURE S9(10) BINARY.
      05 REASON                   PICTURE X(32).
   03 EXCEPTION-EXAMPLE-WORSE REDEFINES U.
      05 VALUE2                   PICTURE S9(05) BINARY.
      05 ERRORCODE                PICTURE X(16).
      05 REASON                   PICTURE X(32).
```

Raising a user exception

Use the COAERR function to raise a user exception. Refer to "COAERR" on page 421 for more details.

Mapping for Typedefs

Overview

This section describes how typedefs are mapped to COBOL.

IDL-to-COBOL mapping for typedefs

COBOL does not support typedefs directly. Any typedefs defined are output in the expanded form of the identifier that has been defined as a typedef, which is used in the group levels of the attributes and operations.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
    typedef fixed<8,2> millions;
    typedef struct database
    {
        string<40> full_name;
        long       date_of_birth;
        string<10> nationality;
        millions   income;
    } personnel;

    attribute millions dollars;
    personnel wages(in string employee_name, in millions
        new_salary);
};
```

2. Based on the preceding IDL, the attribute and operation argument buffer is generated as follows:

```
*************************************************************
* Attribute: dollars
* Mapped name: dollars
* Type: example/millions (read/write)
*************************************************************
01 EXAMPLE-DOLLARS-ARGS.
   03 RESULT PICTURE S9(6)V9(2) PACKED-DECIMAL.
*************************************************************
* Operation: wages
* Mapped name: wages
* Arguments: <in> string emp_name
* <in> example/millions new_salary
* Returns: example/personnel
* User Exceptions: none
*************************************************************
01 EXAMPLE-WAGES-ARGS.
   03 EMP-NAME POINTER             VALUE NULL.
   03 NEW-SALARY                   PICTURE S9(6)V9(2)
                                   PACKED-DECIMAL.
   03 RESULT.
      05 FULL-NAME                 PICTURE X(40).
      05 DATE-OF-BIRTH             PICTURE S9(10) BINARY.
      05 NATIONALITY               PICTURE X(10).
      05 INCOME                    PICTURE S9(6)V9(2)
                                   PACKED-DECIMAL.
```

3. Each typedef defined in the IDL is converted to a level 88 item in COBOL, in the typecode section. The string literal assigned to the level 88 item is the COBOL representation of the typecode for this type. These typecode key representations are used by COBOL applications when processing dynamic types such as sequences and anys.

```
***********************************************************
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
***********************************************************
01 EXAM24-TYPE                    PICTURE X(25).
  COPY CORBATYP.
   88 EXAMPLE-PERSONNEL          VALUE
        "IDL:example/personnel:1.0".
    88 EXAMPLE-MILLIONS           VALUE
        "IDL:example/millions:1.0".
    88 EXAMPLE-DATABASE           VALUE
        "IDL:example/database:1.0".
01 EXAM24-TYPE-LENGTH             PICTURE S9(09) BINARY
                                  VALUE 25.
```

Mapping for the Object Type

Overview

This section describes how the `object` type is mapped to COBOL.

IDL-to-COBOL mapping for typedefs

The IDL `object` type maps to a `POINTER` in COBOL.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
   typedef Object a_object;
   attribute a_object aobject;
   a_object myop(in a_object myobject);
};
```

2. The preceding IDL maps to the following COBOL:

```
*************************************************************
* Attribute:    aobject
* Mapped name:  aobject
* Type:        example/a_object (read/write)
*************************************************************
01 EXAMPLE-AOBJECT-ARGS.
   03 RESULT                          POINTER VALUE NULL.

*************************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:      <in> example/a_object myobject
* Returns:         example/a_object
* User Exceptions: none
*************************************************************
01 EXAMPLE-MYOP-ARGS.
   03 MY-OBJECT                       POINTER VALUE NULL.
   03 RESULT                          POINTER VALUE NULL.
```

Mapping for Constant Types

Overview

This section describes how constant types are mapped to COBOL.

IDL-to-COBOL mapping for constants

Each set of `const` definitions at a different scope are given a unique `01` level COBOL name, where at root scope this name is `GLOBAl-`*`idlmembername`*`-CONSTS`. All other `01` levels are the fully scoped name of the module `/interface-CONSTS`.

You can use the `-O` argument with the Orbix IDL compiler, to override the *`idlmembername`* with an alternative, user-defined name.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
const unsigned long myulong =1000;
const unsigned short myushort = 10;

module example
{
   const string<10> mystring="testing";

   interface example1
   {
      const long mylong =-1000;
      const short myshort = -10;
   };

   interface example2
   {
      const float  myfloat  =10.22;
      const double mydouble = 11.33;
   };
};
```

2. The preceding IDL maps to the following COBOL:

Example 18: *COBOL Example for Constant Types (Sheet 1 of 2)*

```
************************************************************
* Constants in root scope:
************************************************************
01 GLOBAL-EXAM18-CONSTS.
   03 MYULONG                             PICTURE 9(10) BINARY
                                          VALUE 1000.
   03 MYUSHORT                            PICTURE 9(05) BINARY
                                          VALUE 10.
************************************************************
* Constants in example:
************************************************************
01 EXAMPLE-CONSTS.
   03 MYSTRING                            PICTURE X(07)
                                          VALUE "testing".
************************************************************
* Interface:
*     example/example1
*
* Mapped name:
*     example-example1
*
* Inherits interfaces:
*     (none)
************************************************************
************************************************************
* Constants in example/example1:
************************************************************
01 EXAMPLE-EXAMPLE1-CONSTS.
   03 MYLONG                             PICTURE S9(10) BINARY
                                         VALUE -1000.
   03 MYSHORT                            PICTURE S9(05) BINARY
                                         VALUE -10.
************************************************************
* Interface:
*     example/example2
*
* Mapped name:
*     example-example2
*
* Inherits interfaces:
*     (none)
************************************************************

************************************************************
* Constants in example/example2:
```

Example 18: *COBOL Example for Constant Types (Sheet 2 of 2)*

```
***********************************************************
01 EXAMPLE-EXAMPLE2-CONSTS.
   03 MYFLOAT                             COMPUTATIONAL-1
                                          VALUE 1.022e+01.
   03 MYDOUBLE                            COMPUTATIONAL-2
                                          VALUE 1.133e+01.
```

Mapping for Operations

Overview

This section describes how IDL operations are mapped to COBOL.

IDL-to-COBOL mapping for operations

An IDL operation maps to a number of statements in COBOL as follows:

1. A `01` group level is created for each operation. This group level is defined in the *`idlmembername`* copybook and contains a list of the parameters and the return type of the operation. If the parameters or the return type are of a dynamic type (for example, sequences, unbounded strings, or anys), no storage is assigned to them. The `01` group level is always suffixed by `-ARGS` (that is, *`FQN-operationname`*`-ARGS`).
2. A `01` level is created for each interface, in the *`idlmembername`* copybook, with a `PICTURE` clause that contains the length of the longest operation/attribute name within that interface. The value of the `PICTURE` clause corresponds to the length of the largest operation or attribute name plus one, for example:

```
01 FQN-OPERATION          PICTURE X(maxoperationnamestring+1)
```

The extra space is added because the operation name must be terminated by a space when it is passed to the COBOL runtime by `ORBEXEC`.

A level `88` item is also created as follows for each operation, with a value clause that contains the string literal representing the operation name:

```
88 FQN-operationname        VALUE "operation-name-string".
```

A level `01` item is also created as follows, which defines the length of the maximum string representation of the interface operation:

```
01 FQN-OPERATION-LENGTH     PICTURE9(09) BINARY
                            VALUE maxoperationnamestring+1
```

3. The preceding identifiers in point 2 are referenced in a `select` clause that is generated in the *idlmembernameD* copybook. This `select` clause calls the appropriate operation paragraphs, which are discussed next.
4. The operation/attribute procedures are generated in the *idlmembernameS* source member when you specify the `-Z` argument with the Orbix IDL compiler.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
    long my_operation1(in long mylong);
    short my_operation2(in short myshort);
};
```

2. Based on the preceding IDL, the following COBOL is generated in the *idlmembername* copybook:

```
************************************************************
* Operation: my_operation1
* Mapped name: my_operation1
* Arguments: <in> long mylong
* Returns: long
* User Exceptions: none
************************************************************
01 EXAMPLE-MY-OPERATION1-ARGS.
   03 MYLONG PICTURE S9(10) BINARY.
   03 RESULT PICTURE S9(10) BINARY.
************************************************************
* Operation: my_operation2
* Mapped name: my_operation2
* Arguments: <in> short myshort
* Returns: short
* User Exceptions: none
************************************************************
01 EXAMPLE-MY-OPERATION2-ARGS.
   03 MYSHORT PICTURE S9(05) BINARY.
   03 RESULT PICTURE S9(05) BINARY.
```

3. The following code is also generated in the *idlmembername* copybook:

```
**********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************
01 EXAMPLE-OPERATION                 PICTURE X(30).
   88 EXAMPLE-MY-OPERATION1          VALUE
       "my_operation1:IDL:example:1.0".
   88 EXAMPLE-MY-OPERATION2          VALUE
      "my_operation2:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH          PICTURE 9(09) BINARY
                                     VALUE 30.
```

4. The following code is generated in the *idlmembername*D copybook member:

```
EVALUATE TRUE
    WHEN EXAMPLE-MY-OPERATION1
    PERFORM DO-EXAMPLE-MY-OPERATION1
    WHEN EXAMPLE-MY-OPERATION2
    PERFORM DO-EXAMPLE-MY-OPERATION2
END-EVALUATE
```

5. The following is an example of the code in the *idlmembername*S source member:

Example 19: *Server Mainline Example for Operations (Sheet 1 of 3)*

```
PROCEDURE DIVISION.
    ENTRY "DISPATCH".
    CALL "COAREQ" USING REQUEST-INFO.
    SET WS-COAREQ TO TRUE.
    PERFORM CHECK-STATUS.
* Resolve the pointer reference to the interface name which
* is the fully scoped interface name
    CALL "STRGET" USING INTERFACE-NAME
                        WS-INTERFACE-NAME-LENGTH
                        WS-INTERFACE-NAME.
    SET WS-STRGET TO TRUE.
    PERFORM CHECK-STATUS.

**********************************************************
```

Example 19: *Server Mainline Example for Operations (Sheet 2 of 3)*

```
* Interface(s) :
***********************************************************
    MOVE SPACES TO EXAMPLE-OPERATION.

***********************************************************
* Evaluate Interface(s) :
***********************************************************

    EVALUATE WS-INTERFACE-NAME
    WHEN 'IDL:example:1.0'

* Resolve the pointer reference to the operation information
    CALL "STRGET" USING OPERATION-NAME
                        EXAMPLE-OPERATION-LENGTH
                        EXAMPLE-OPERATION
    SET WS-STRGET TO TRUE
    PERFORM CHECK-STATUS
    END-EVALUATE.

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    GOBACK.

 DO-EXAMPLE-MY-OPERATION1.
    CALL "COAGET" USING EXAMPLE-MY-OPERATION1-ARGS.
    SET WS-COAGET TO TRUE.
    PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING EXAMPLE-MY-OPERATION1-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.

 DO-EXAMPLE-MY-OPERATION2.
     CALL "COAGET" USING EXAMPLE-MY-OPERATION2-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING EXAMPLE-MY-OPERATION2-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.

***********************************************************
```

Example 19: *Server Mainline Example for Operations (Sheet 3 of 3)*

```
* Check Errors Copybook
************************************************************
    COPY CHKERRS.
```

Mapping for Attributes

Overview

This section describes how IDL attributes are mapped to COBOL.

Similarity to mapping for operations

The IDL mapping for attributes is very similar to the IDL mapping for operations, but with the following differences:

- IDL attributes map to COBOL as level `88` items with a `-GET-` and `-SET-` prefix. Two level `88` items are created for each attribute (that is, one with a `-GET-` prefix, and one with a `-SET-` prefix). However, readonly attributes only map to one level `88` item, with a `-GET-` prefix.
- An attribute's parameters are always treated as return types (that is, a `01` group level created for a particular attribute always contains just one immediate sub-element, `RESULT`).

IDL-to-COBOL mapping for attributes

An IDL attribute maps to a number of statements in COBOL as follows:

1. A `01` group level is created for each attribute. This group level is defined in the *`idlmembername`* copybook and contains one immediate sub-element, `RESULT`. If the attribute is a complex type, the `RESULT` sub-element contains a list of the attribute's parameters as lower-level elements. If the parameters are of a dynamic type (for example, sequences, unbounded strings, or anys), no storage is assigned to them. The `01` group level is always suffixed by `-ARGS` (that is, *`FQN-attributename`*`-ARGS`).
2. A `01` level is created for each interface, in the *`idlmembername`* copybook, with a `PICTURE` clause that contains the length of the longest operation/attribute name within that interface. The value of the `PICTURE` clause corresponds to the length of the largest operation or attribute name plus one, for example:

   ```
   01 FQN-OPERATION          PICTURE X(maxoperationnamestring+1)
   ```

   The extra space is added because an operation name must be terminated by a space when it is passed to the COBOL runtime by `ORBEXEC`.

Two level `88` items are also created as follows for each attribute, with `-GET-` and `-SET-` prefixes, and value clauses that contain the string literal representing the attribute name:

```
88 FQN-GET-attributename      VALUE
                              "_get_attribute_name_string".
88 FQN-SET-attributename      VALUE
                              "_set_attribute_name_string".
```

Note: In the case of readonly attributes, only one level `88` item is created, with a `-GET-` prefix. Level `88` items are created under the same `01` level for all attributes and operations that correspond to a particular interface.

A level `01` item is also created as follows, which defines the length of the maximum string representation of the interface operation:

```
01 FQN-OPERATION-LENGTH    PICTURE9(09) BINARY
                           VALUE maxoperationnamestring+1
```

3. The preceding identifiers in point 2 are referenced in a `select` clause that is generated in the *`idlmembername`*`D` copybook. This `select` clause calls the appropriate operation paragraphs, which are discussed next.
4. The operation/attribute procedures are generated in the *`idlmembername`*`S` source member when you specify the `-Z` argument with the Orbix IDL compiler.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
    readonly attribute long mylong;
    attribute short myshort;
};
```

2. Based on the preceding IDL, the following COBOL is generated in the *idlmembername* copybook:

```
************************************************************
* Attribute:    mylong
* Mapped name:  mylong
* Type:         long (readonly)
************************************************************
 01 EXAMPLE-MYLONG-ARGS.
    03 RESULT                       PICTURE S9(10) BINARY.
************************************************************
* Attribute:    myshort
* Mapped name:  myshort
* Type:         short (read/write)
************************************************************
 01 EXAMPLE-MYSHORT-ARGS.
    03 RESULT                      PICTURE S9(05) BINARY.
```

3. The following code is also generated in the *idlmembername* copybook:

```
 01 EXAMPLE-OPERATION              PICTURE X(29).
    88 EXAMPLE-GET-MYLONG          VALUE
        "_get_mylong:IDL:example:1.0".
    88 EXAMPLE-GET-MYSHORT         VALUE
        "_get_myshort:IDL:example:1.0".
    88 EXAMPLE-SET-MYSHORT         VALUE
        "_set_myshort:IDL:example:1.0".
 01 EXAMPLE-OPERATION-LENGTH       PICTURE 9(09) BINARY
                                   VALUE 29.
```

4. The following code is generated in the *idlmembername*D copybook member:

```
EVALUATE TRUE
    WHEN EXAMPLE-GET-MYLONG
    PERFORM DO-EXAMPLE-GET-MYLONG
    WHEN EXAMPLE-GET-MYSHORT
    PERFORM DO-EXAMPLE-GET-MYSHORT
    WHEN EXAMPLE-SET-MYSHORT
    PERFORM DO-EXAMPLE-SET-MYSHORT
END-EVALUATE
```

5. The following is an example of the code in the *idlmembername*S source member:

Example 20: *Server Mainline Example for Attributes (Sheet 1 of 2)*

```
PROCEDURE DIVISION.
    ENTRY "DISPATCH".
    CALL "COAREQ" USING REQUEST-INFO.
    SET WS-COAREQ TO TRUE.
    PERFORM CHECK-STATUS.
* Resolve the pointer reference to the interface name which
* is the fully scoped interface name
    CALL "STRGET" USING INTERFACE-NAME OF REQUEST-INFO
                        WS-INTERFACE-NAME-LENGTH
                        WS-INTERFACE-NAME.
    SET WS-STRGET TO TRUE.
    PERFORM CHECK-STATUS.

***********************************************************
* Interface(s) :
***********************************************************
    MOVE SPACES TO EXAMPLE-OPERATION.

***********************************************************
* Evaluate Interface(s) :
***********************************************************

    EVALUATE WS-INTERFACE-NAME
    WHEN 'IDL:example:1.0'

* Resolve the pointer reference to the operation information
    CALL "STRGET" USING OPERATION-NAME OF REQUEST-INFO
                        EXAMPLE-OPERATION-LENGTH
                        EXAMPLE-OPERATION
    SET WS-STRGET TO TRUE
    PERFORM CHECK-STATUS
    END-EVALUATE.

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    GOBACK.

 DO-EXAMPLE-GET-MYLONG.
    CALL "COAGET" USING EXAMPLE-MYLONG-ARGS.
    SET WS-COAGET TO TRUE.
    PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING EXAMPLE-MYLONG-ARGS.
     SET WS-COAPUT TO TRUE.
```

Example 20: *Server Mainline Example for Attributes (Sheet 2 of 2)*

```
     PERFORM CHECK-STATUS.

 DO-EXAMPLE-GET-MYSHORT.
     CALL "COAGET" USING EXAMPLE-MYSHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING EXAMPLE-MYSHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.

 DO-EXAMPLE-SET-MYSHORT.
     CALL "COAGET" USING EXAMPLE-MYSHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING EXAMPLE-MYSHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.

***********************************************************
* Check Errors Copybook
***********************************************************
    COPY CHKERRS.
```

Mapping for Operations with a Void Return Type and No Parameters

Overview

This section describes how IDL operations that have a void return type and no parameters are mapped to COBOL.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
   void myoperation();
};
```

2. The preceding IDL maps to the following COBOL:

Example 21: *COBOL Example for Void Return Type (Sheet 1 of 2)*

```
************************************************************
* Interface:
*     example
*
* Mapped name:
*     example
*
* Inherits interfaces:
*     (none)
************************************************************
************************************************************
* Operation:        myoperation
* Mapped name:      myoperation
* Arguments:        None
* Returns:          void
* User Exceptions: none
************************************************************
01 EXAMPLE-MYOPERATION-ARGS.
   03 FILLER                               PICTURE X(01).
************************************************************
    COPY EXAM19X.
************************************************************
```

Example 21: *COBOL Example for Void Return Type (Sheet 2 of 2)*

```
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************

01 EXAMPLE-OPERATION                          PICTURE X(28).
   88 EXAMPLE-MYOPERATION                     VALUE
       "myoperation:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH                   PICTURE 9(09)
                                              BINARY VALUE 28.
```

Note: The filler is included for completeness, to allow the application to compile, but the filler is never actually referenced. The other code segments are generated as expected.

Mapping for Inherited Interfaces

Overview

This section describes how inherited interfaces are mapped to COBOL.

IDL-to-COBOL mapping for inherited interfaces

An IDL interface that inherits from other interfaces includes all the attributes and operations of those other interfaces. In the header of the interface being processed, the Orbix IDL compiler generates an extra comment that contains a list of all the inherited interfaces.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface Account
{
   attribute short mybaseshort;
   void mybasefunc(in long mybaselong);
};

interface SavingAccount : Account
{
   attribute short myshort;
   void myfunc(in long mylong);
};
```

2. The preceding IDL maps to the following COBOL in the *idlmembername* copybook:

Example 22: *idlmembernameX Copybook Example (Sheet 1 of 4)*

```
***********************************************************
* Interface:
*     Account
*
* Mapped name:
*     Account
*
* Inherits interfaces:
*     (none)
***********************************************************
```

Example 22: *idlmembernameX Copybook Example (Sheet 2 of 4)*

```
************************************************************
* Attribute:     mybaseshort
* Mapped name:   mybaseshort
* Type:          short (read/write)
************************************************************
01 ACCOUNT-MYBASESHORT-ARGS.
   03 RESULT                                  PICTURE S9(05)
                                              BINARY.
************************************************************
* Operation:        mybasefunc
* Mapped name:      mybasefunc
* Arguments:        <in> long mybaselong
* Returns:          void
* User Exceptions: none
************************************************************
01 ACCOUNT-MYBASEFUNC-ARGS.
   03 MYBASELONG                              PICTURE S9(10)
                                              BINARY.
************************************************************
* Interface:
*     SavingAccount
*
* Mapped name:
*     SavingAccount
*
* Inherits interfaces:
*     Account
************************************************************
************************************************************
* Attribute:     myshort
* Mapped name:   myshort
* Type:          short (read/write)
************************************************************
01 SAVINGACCOUNT-MYSHORT-ARGS.
   03 RESULT                                  PICTURE S9(05)
                                              BINARY.
************************************************************
* Attribute:     mybaseshort
* Mapped name:   mybaseshort
* Type:          short (read/write)
************************************************************
01 SAVINGACCOUNT-MYBASESHORT-ARGS.
   03 RESULT                                  PICTURE S9(05)
                                              BINARY.
```

Example 22: *idlmembernameX Copybook Example (Sheet 3 of 4)*

```
************************************************************
* Operation:       myfunc
* Mapped name:     myfunc
* Arguments:       <in> long mylong
* Returns:         void
* User Exceptions: none
************************************************************
01 SAVINGACCOUNT-MYFUNC-ARGS.
   03 MYLONG                                PICTURE S9(10)
                                            BINARY.
************************************************************
* Operation:       mybasefunc
* Mapped name:     mybasefunc
* Arguments:       <in> long mybaselong
* Returns:         void
* User Exceptions: none
************************************************************
01 SAVINGACCOUNT-MYBASEFUNC-ARGS.
   03 MYBASELONG                            PICTURE S9(10)
                                            BINARY.
************************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
************************************************************
01 ACCOUNT-OPERATION                      PICTURE X(33).
   88 ACCOUNT-GET-MYBASESHORT             VALUE
       "_get_mybaseshort:IDL:Account:1.0".
   88 ACCOUNT-SET-MYBASESHORT             VALUE
       "_set_mybaseshort:IDL:Account:1.0".
   88 ACCOUNT-MYBASEFUNC                  VALUE
       "mybasefunc:IDL:Account:1.0".
01 ACCOUNT-OPERATION-LENGTH               PICTURE 9(09)
                                          BINARY VALUE 33.
01 SAVINGACCOUNT-OPERATION                PICTURE X(39).
   88 SAVINGACCOUNT-GET-MYSHORT           VALUE
       "_get_myshort:IDL:SavingAccount:1.0".
   88 SAVINGACCOUNT-SET-MYSHORT           VALUE
       "_set_myshort:IDL:SavingAccount:1.0".
   88 SAVINGACCOUNT-MYFUNC                VALUE
       "myfunc:IDL:SavingAccount:1.0".
   88 SAVINGACCOUNT-GET-MYBASESHORT       VALUE
       "_get_mybaseshort:IDL:SavingAccount:1.0".
```

Example 22: *idlmembernameX Copybook Example (Sheet 4 of 4)*

```
    88 SAVINGACCOUNT-SET-MYBASESHORT       VALUE
        "_set_mybaseshort:IDL:SavingAccount:1.0".
    88 SAVINGACCOUNT-MYBASEFUNC            VALUE
        "mybasefunc:IDL:SavingAccount:1.0".
01 SAVINGACCOUNT-OPERATION-LENGTH         PICTURE 9(09)
                                          BINARY VALUE 39.
```

3. The following code is generated in the *idlmembername*D copybook:

```
EVALUATE TRUE
    WHEN ACCOUNT-GET-MYBASESHORT
        PERFORM DO-ACCOUNT-GET-MYBASESHORT
    WHEN ACCOUNT-SET-MYBASESHORT
        PERFORM DO-ACCOUNT-SET-MYBASESHORT
    WHEN ACCOUNT-MYBASEFUNC
        PERFORM DO-ACCOUNT-MYBASEFUNC
    WHEN SAVINGACCOUNT-GET-MYSHORT
        PERFORM DO-SAVINGACCOUNT-GET-MYSHORT
    WHEN SAVINGACCOUNT-SET-MYSHORT
        PERFORM DO-SAVINGACCOUNT-SET-MYSHORT
    WHEN SAVINGACCOUNT-MYFUNC
        PERFORM DO-SAVINGACCOUNT-MYFUNC
    WHEN SAVINGACCOUNT-GET-MYBASESHORT
        PERFORM DO-SAVINGACCOUNT-GET-MYBA-6FF2
    WHEN SAVINGACCOUNT-SET-MYBASESHORT
        PERFORM DO-SAVINGACCOUNT-SET-MYBA-AE11
    WHEN SAVINGACCOUNT-MYBASEFUNC
        PERFORM DO-SAVINGACCOUNT-MYBASEFUNC
END-EVALUATE
```

4. The following is an example of the code in the *idlmembername*S server implementation program:

Example 23: *Server Mainline Example (Sheet 1 of 4)*

```
***********************************************************
* Interface(s) :
***********************************************************
    MOVE SPACES TO ACCOUNT-OPERATION.
    MOVE SPACES TO SAVINGACCOUNT-OPERATION.

***********************************************************
* Evaluate Interface(s) :
***********************************************************
```

Example 23: *Server Mainline Example (Sheet 2 of 4)*

```
    EVALUATE WS-INTERFACE-NAME
    WHEN 'IDL:Account:1.0'

* Resolve the pointer reference to the operation information
    CALL "STRGET" USING OPERATION-NAME
                        ACCOUNT-OPERATION-LENGTH
                        ACCOUNT-OPERATION
    SET WS-STRGET TO TRUE
    PERFORM CHECK-STATUS
    WHEN 'IDL:SavingAccount:1.0'

* Resolve the pointer reference to the operation information
    CALL "STRGET" USING OPERATION-NAME
                        SAVINGACCOUNT-OPERATION-LENGTH
                        SAVINGACCOUNT-OPERATION
    SET WS-STRGET TO TRUE
    PERFORM CHECK-STATUS
    END-EVALUATE.

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    GOBACK.

 DO-ACCOUNT-GET-MYBASESHORT.
     CALL "COAGET" USING ACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING ACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-ACCOUNT-SET-MYBASESHORT.
     CALL "COAGET" USING ACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING ACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-ACCOUNT-MYBASEFUNC.
     CALL "COAGET" USING ACCOUNT-MYBASEFUNC-ARGS.
```

Example 23: *Server Mainline Example (Sheet 3 of 4)*

```
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING ACCOUNT-MYBASEFUNC-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-GET-MYSHORT.
     CALL "COAGET" USING SAVINGACCOUNT-MYSHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYSHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-SET-MYSHORT.
     CALL "COAGET" USING SAVINGACCOUNT-MYSHORT-ARGS.
           SET WS-COAGET TO TRUE.
           PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYSHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-MYFUNC.
     CALL "COAGET" USING SAVINGACCOUNT-MYFUNC-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.
* TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYFUNC-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-GET-MYBA-6FF2.
     CALL "COAGET" USING SAVINGACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYBASESHORT-ARGS.
```

Example 23: *Server Mainline Example (Sheet 4 of 4)*

```
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-SET-MYBA-AE11.
     CALL "COAGET" USING SAVINGACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

* TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYBASESHORT-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.
 DO-SAVINGACCOUNT-MYBASEFUNC.
     CALL "COAGET" USING SAVINGACCOUNT-MYBASEFUNC-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

     CALL "COAPUT" USING SAVINGACCOUNT-MYBASEFUNC-ARGS.
     SET WS-COAPUT TO TRUE.
     PERFORM CHECK-STATUS.

***********************************************************
* Check Errors Copybook
***********************************************************
     COPY CHKERRS.
```

Mapping for Multiple Interfaces

Overview

This section describes how multiple interfaces are mapped to COBOL.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example1
{
    readonly attribute long mylong;
    attribute short myshort;
};

interface example2
{
    readonly attribute long mylong;
    attribute short myshort;
};
```

2. Based on the preceding IDL, the following code is generated in the *idlmembername*S member:

Example 24: *Server Implementation Example (Sheet 1 of 3)*

```
     ENTRY "DISPATCH".
     CALL "COAREQ" USING REQUEST-INFO.
     SET WS-COAREQ TO TRUE.
     PERFORM CHECK-STATUS.
* Resolve the pointer reference to the interface name which
* is the fully scoped interface name
      CALL "STRGET" USING INTERFACE-NAME
                          WS-INTERFACE-NAME-LENGTH
                          WS-INTERFACE-NAME.
      SET WS-STRGET TO TRUE.
      PERFORM CHECK-STATUS.

*************************************************************
* Interface(s) :
*************************************************************
      MOVE SPACES TO EXAMPLE1-OPERATION.
      MOVE SPACES TO EXAMPLE2-OPERATION.
```

Example 24: *Server Implementation Example (Sheet 2 of 3)*

```
***********************************************************
* Evaluate Interface(s) :
***********************************************************

     EVALUATE WS-INTERFACE-NAME
     WHEN 'IDL:example1:1.0'

* Resolve the pointer reference to the operation information
     CALL "STRGET" USING OPERATION-NAME
                         EXAMPLE1-OPERATION-LENGTH
                         EXAMPLE1-OPERATION
     SET WS-STRGET TO TRUE
     PERFORM CHECK-STATUS
     WHEN 'IDL:example2:1.0'

* Resolve the pointer reference to the operation information
     CALL "STRGET" USING OPERATION-NAME
                         EXAMPLE2-OPERATION-LENGTH
                         EXAMPLE2-OPERATION
     SET WS-STRGET TO TRUE
     PERFORM CHECK-STATUS
     END-EVALUATE.

 COPY EXAM23D.
     GOBACK.

 DO-EXAMPLE1-GET-MYLONG.
     CALL "COAGET" USING EXAMPLE1-MYLONG-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE1-MYLONG-ARGS.
      SET WS-COAPUT TO TRUE.
      PERFORM CHECK-STATUS.
 DO-EXAMPLE1-GET-MYSHORT.
      CALL "COAGET" USING EXAMPLE1-MYSHORT-ARGS.
      SET WS-COAGET TO TRUE.
      PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE1-MYSHORT-ARGS.
      SET WS-COAPUT TO TRUE.
```

Example 24: *Server Implementation Example (Sheet 3 of 3)*

```
      PERFORM CHECK-STATUS.
 DO-EXAMPLE1-SET-MYSHORT.
      CALL "COAGET" USING EXAMPLE1-MYSHORT-ARGS.
      SET WS-COAGET TO TRUE.
      PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE1-MYSHORT-ARGS.
      SET WS-COAPUT TO TRUE.
      PERFORM CHECK-STATUS.
 DO-EXAMPLE2-GET-MYLONG.
      CALL "COAGET" USING EXAMPLE2-MYLONG-ARGS.
      SET WS-COAGET TO TRUE.
      PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE2-MYLONG-ARGS.
      SET WS-COAPUT TO TRUE.
      PERFORM CHECK-STATUS.
 DO-EXAMPLE2-GET-MYSHORT.
      CALL "COAGET" USING EXAMPLE2-MYSHORT-ARGS.
      SET WS-COAGET TO TRUE.
      PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE2-MYSHORT-ARGS.
      SET WS-COAPUT TO TRUE.
      PERFORM CHECK-STATUS.
 DO-EXAMPLE2-SET-MYSHORT.
      CALL "COAGET" USING EXAMPLE2-MYSHORT-ARGS.
      SET WS-COAGET TO TRUE.
      PERFORM CHECK-STATUS.

 * TODO:  Add your operation specific code here

      CALL "COAPUT" USING EXAMPLE2-MYSHORT-ARGS.
      SET WS-COAPUT TO TRUE.
      PERFORM CHECK-STATUS.
***********************************************************
* Check Errors Copybook
***********************************************************
    COPY CHKERRS.
```

Orbix IDL Compiler

This chapter describes the Orbix IDL compiler in terms of how to run it in batch and z/OS UNIX System Services, the COBOL source code and copybook members that it creates, the arguments that you can use with it, and the configuration variables that it uses.

In this chapter

This chapter discusses the following topics:

Note: The supplied demonstrations include examples of JCL that can be used to run the Orbix IDL compiler. You can modify the demonstration JCL as appropriate, to suit your applications. Any occurrences of *`orbixhlq`* in this chapter are meant to represent the high-level qualifier for your Orbix Mainframe installation. If you are using z/OS UNIX System Services, references to z/OS member names can be interchanged with filenames, unless otherwise specified.

Running the Orbix IDL Compiler

Overview

You can use the Orbix IDL compiler to generate COBOL source code and copybooks from IDL definitions. This section describes how to run the Orbix IDL compiler, both in batch and in z/OS UNIX System Services.

In this section

This section discusses the following topics:

Running the Orbix IDL Compiler in Batch

Overview

This subsection describes how to run the Orbix IDL compiler in batch. It discusses the following topics:

- "Orbix IDL compiler configuration" on page 317.
- "Running the Orbix IDL compiler" on page 317.
- "Example of the batch SIMPLIDL JCL" on page 318.
- "Description of the JCL" on page 319.
- "Obtaining IDL in batch" on page 319.
- "ORXCOPY" on page 321.

Orbix IDL compiler configuration

The Orbix IDL compiler uses the Orbix configuration member for its settings. The JCL that runs the compiler uses the `IDL` member in the *`orbixhlq`*`.CONFIG` configuration PDS.

Running the Orbix IDL compiler

For the purposes of this example, the COBOL source is generated in the first step of the supplied *`orbixhlq`*`.DEMO.CBL.BLD.JCLLIB(SIMPLIDL)` JCL. This JCL is used to run the Orbix IDL compiler for the simple persistent POA-based server demonstration supplied with your installation.

Example of the batch SIMPLIDL JCL

The following is the supplied JCL to run the Orbix IDL compiler for the batch version of the simple persistent POA-based server demonstration:

```
//SIMPLIDL JOB   (),
//          CLASS=A,
//          MSGCLASS=X,
//          MSGLEVEL=(1,1),
//          REGION=0M,
//          TIME=1440,
//          NOTIFY=&SYSUID,
//          COND=(4,LT)
//*-------------------------------------------------------------
//* Orbix - Generate the COBOL copybooks for the Simple Client
//*-------------------------------------------------------------
//          JCLLIB ORDER=(orbixhlq.PROCLIB)
//          INCLUDE MEMBER=(ORXVARS)
//*
//IDLCBL   EXEC ORXIDL,
//          SOURCE=SIMPLE,
//          IDL=&ORBIX..DEMO.IDL,
//          COPYLIB=&ORBIX..DEMO.CBL.COPYLIB,
//          IMPL=&ORBIX..DEMO.CBL.SRC,
//          IDLPARM='-cobol'
```

The preceding JCL generates COBOL copybooks from an IDL member called `SIMPLE` (see the `SOURCE=SIMPLE` line).

Note: COBOL copybooks are always generated by default when you run the Orbix IDL compiler.

The preceding JCL does not specify any compiler arguments (see the `IDLPARM` line); therefore, it cannot generate any COBOL source code members, which can only be generated if you specify the `-S` and `-Z` arguments. See "Orbix IDL Compiler Arguments" on page 327 for more details.

Note: The preceding JCL is specific to the batch version of the supplied simple persistent POA-based server demonstration, and is contained in *orbixhlq*.DEMO.CBL.BLD.JCLLIB(SIMPLIDL). For details of the JCL for the CICS or IMS version of the demonstration see "Example of the SIMPLIDL JCL" on page 62 or "Example of the SIMPLIDL JCL" on page 138.

Description of the JCL

The settings and data definitions contained in the preceding JCL can be explained as follows:

`ORBIX`	The high-level qualifier for your Orbix Mainframe installation, which is set in *`orbixhlq`*`.PROCLIB(ORXVARS)`.
`SOURCE`	The IDL member to be compiled.
`IDL`	The PDS for the IDL member.
`COPYLIB`	The PDS for the COBOL copybooks generated by the Orbix IDL compiler.
`IMPL`	The PDS for the COBOL source code members generated by the Orbix IDL compiler.
`IDLPARM`	The plug-in to the Orbix IDL compiler to be used (in the preceding example, it is the COBOL plug-in), and any arguments to be passed to it (in the preceding example, no arguments are specified). See "Specifying Compiler Arguments" on page 330 for details of how to specify the Orbix IDL compiler arguments as parameters to it.

Obtaining IDL in batch

In batch, IDL resides in a data set or PDS member with the following attributes:

Attribute	Value
Record format	Fixed block (FB)
Record length	80
Block size	27920 (the block size might vary, depending on your installation standards)

Each record in the data set or PDS member should not exceed 71 characters. If a record is longer than 71 characters, the record must be continued into the next record, as follows:

- Code the IDL record up to column 71.
- Put the "\" continuation character in column 72.
- Continue the IDL record beginning in column 1 of the next record.

The following is an example of the preceding points:

```
…
module Banking
{
     typedef float CashAmount;  //Define a named type to repr\
esent money
…
```

When IDL is brought into the batch environment from another environment, such as UNIX or Windows, the records in the IDL might be longer than 71 characters. To avoid having to edit the IDL manually to conform to the continuation rules, use the following procedure to obtain IDL in batch:

1. Allocate a data set with the following attributes:

Attribute	Value
Record format	Variable Blocked (VB)
Record length	2052
Block size	27998
Space allocation units	Tracks
First extent	1
Second extent	1
Data set type	Physical Sequential (PS)

2. Use File Transfer Protocol (FTP) to copy the IDL from Windows or UNIX to this data set.
3. Run the `ORXCOPY` program to copy the IDL from the data set in point 2 into the IDL data set or PDS member. `ORXCOPY` automatically formats each line of IDL that is greater than 71 characters.

ORXCOPY

The following is an example of `ORXCOPY`:

```
//JOBNAME JOB …
//*
//         JCLLIB ORDER=(orbixhlq.ORBIX63.PROCLIB)
//         INCLUDE MEMBER=(ORXVARS)
//*
//* Copy from a variable-length record IDL file into
//* the (fixed-length record) IDL file. Long
//* lines will be split across records with a
//* backslash.
//*
//GO  EXEC PROC=ORXG,
1 //    PROGRAM=ORXCOPY,
//    PPARM='DD:IN DD:OUT(LONG)'
2 //IN  DD DISP=SHR,DSN=&ORBIX..LONG.IDL
3 //OUT DD DISP=SHR,DSN=&ORBIX..DEMO.IDL
```

The preceding code can be explained as follows:

1. The `ORXCOPY` program is used to copy the IDL from a variable length data set into a fixed length PDS with long lines correctly formatted for continuation.
2. `&ORBIX..LONG.IDL` is a variable length data set that contains IDL that has been copied from Windows or UNIX via FTP.
3. `&ORBIX..DEMO.IDL` is a fixed length PDS. The IDL is copied from the variable length data set into the PDS member called `LONG`. Any line that was originally longer than 71 characters is properly formatted for continuation onto the next line.

Running the Orbix IDL Compiler in UNIX System Services

Overview

This subsection describes how to run the Orbix IDL compiler in z/OS UNIX System Services. It discusses the following topics:

- "Orbix IDL compiler configuration" on page 322.
- "Prerequisites to running the Orbix IDL compiler" on page 322.
- "Running the Orbix IDL compiler" on page 322.

Note: Even though you can run the Orbix IDL compiler in z/OS UNIX System Services, Orbix does not support subsequent building of Orbix COBOL applications in z/OS UNIX System Services.

Orbix IDL compiler configuration

The Orbix IDL compiler uses the Orbix IDL configuration file for its settings. This configuration file is set via the `IT_IDL_CONFIG_PATH` export variable.

Prerequisites to running the Orbix IDL compiler

Before you can run the Orbix IDL compiler, enter the following command to initialize your Orbix environment (where *`YOUR_ORBIX_INSTALL`* represents the full path to your Orbix installation directory):

```
cd $YOUR_ORBIX_INSTALL/etc/bin
. default-domain_env.sh
```

Note: You only need to do this once per logon.

Running the Orbix IDL compiler

The general format for running the Orbix IDL compiler is:

```
idl -cobol[:-argument1][:-argument2][…] idlfilename.idl
```

In the preceding example, *`[:-argument1]`* and *`[:-argument2]`* represent optional arguments that can be passed as parameters to the Orbix IDL compiler, and *`idlfilename`* represents the name of the IDL file from which you want to generate the COBOL source and copybooks.

For example, consider the following command:

```
idl -cobol:-S simple.idl
```

The preceding command instructs the Orbix IDL compiler to use the `simple.idl` file. The Orbix IDL compiler always generates COBOL copybooks by default, and the `-S` argument indicates that it should also generate an *`idlfilename`*`S` server mainline source code file. See "Orbix IDL Compiler Arguments" on page 327 for more details of Orbix IDL compiler arguments. See "Generated COBOL Source and Copybooks" on page 324 and "Orbix IDL Compiler Configuration" on page 353 for more details of default generated filenames.

Generated COBOL Source and Copybooks

Overview

This section describes the various COBOL source code and copybook members that the Orbix IDL compiler can generate.

Generated members

Table 19 provides an overview and description of the COBOL source code and copybooks that the Orbix IDL compiler can generate, based on the IDL member name.

Note: In the following table, *idlmembername* represents the IDL member name (in batch) or IDL filename (in z/OS UNIX System Services).

Table 19: *Generated Source Code and Copybook Members*

Member Name	Member Type	Compiler Argument Used to Generate	Description
*idlmembername*S	Source code	-Z	This is the server implementation source code member. It contains stub paragraphs for all the callable operations. It is only generated if you specify the -Z argument.
*idlmembername*SV	Source code	-S	This is the server mainline source code member. It is only generated if you specify the -S argument.
idlmembername	Copybook	Generated by default	This copybook contains data definitions that are used for working with operation parameters and return values for each interface defined in the IDL member.
*idlmembername*X	Copybook	Generated by default	This copybook contains data definitions that are used by the Orbix COBOL runtime to support the interfaces defined in the IDL member. It is automatically included in the *idlmembername* copybook.

Table 19: *Generated Source Code and Copybook Members*

Member Name	Member Type	Compiler Argument Used to Generate	Description
*idlmembername*D	Copybook	Generated by default	This copybook contains procedural code for performing the correct paragraph for the requested operation. It is automatically included in the *idlmembername*S source code member.

Member name restrictions

If the IDL member name exceeds six characters, the Orbix IDL compiler uses only the first six characters of that name when generating the source code and copybook member names. This allows space for appending the two-character `SV` suffix to the server mainline source code member name, while allowing it to adhere to the eight-character maximum size limit for z/OS member names. In such cases, each of the other generated member names is also based on only the first six characters, and is appended with its own suffix, as appropriate. Member names (and filenames on z/OS UNIX System Services) are always generated in uppercase.

Filename extensions on z/OS UNIX System Services

If you are running the Orbix IDL compiler in z/OS UNIX System Services, it is recommended (but not mandatory) that you specify certain extensions for the generated filenames via configuration variables. The recommended extensions and their corresponding filenames and configuration variables are as follows:

Table 20: *Recommended Filename Extensions*

Filename	File Type	Recommended Extension	Configuration Variable
*idlfilename*S	Server implementation source code	`.xxx`	`ImplementationExtension`
*idlfilename*SV	Server mainline source code	`.cbl`	`CobolExtension`
idlfilename	Copybook	`.cpy`	`CopybookExtension`
*idlfilename*X	Copybook	`.cpy`	`CopybookExtension`
*idlfilename*D	Copybook	`.cpy`	`CopybookExtension`

Note: The settings for `ImplementationExtension`, `CobolExtension`, and `CopybookExtension` are left blank by default in the Orbix IDL configuration file. See "COBOL Configuration Variables" on page 354 for more details.

Orbix IDL Compiler Arguments

Overview

This section describes the various arguments that you can specify as parameters to the Orbix IDL compiler.

In this section

This section discusses the following topics:

Summary of the Arguments

Overview

For the purposes of Orbix COBOL application development, the Orbix IDL compiler arguments can be categorized as follows:

- General arguments not specific to the COBOL plug-in.
- Arguments specific to the COBOL plug-in and qualified by the `-cobol` switch.

Note: Orbix IDL compiler arguments relating to other plug-ins are also available, such as those concerned with PL/I, C++ or Java application development. See the relevant Orbix programmer's guides for those languages for more details of their associated arguments.

This subsection provides an introductory overview of both the general Orbix IDL compiler arguments and those that are specific to the COBOL plug-in. Each argument that is specific to the COBOL plug-in is explained in more detail further on in this section.

Summary of general arguments

The general Orbix IDL compiler arguments can be summarized as follows:

`-D`*`name`*`[=`*`value`*`]`	Defines the preprocesser's name.
`-E`	Runs preprocessor only, prints on `stdout`.
`-I`*`dir`*	Includes *`dir`* in search path for preprocessor.
`-N`	Generates code for `#include` files.
`-U`*`name`*	Undefines name for preprocessor.
`-u`	Prints usage message and exits.
`-V`	Print version information and exits.
`-v`	Traces compilation stages.
`-w`	Suppresses IDL compiler warning messages.
`-flags`	Lists all valid arguments to the Orbix IDL compiler.

Note: All these arguments are optional. This means that they do not have to be specified as parameters to the Orbix IDL compiler.

Summary of COBOL plug-in arguments

The Orbix IDL compiler arguments that are specific to the COBOL plug-in can be summarized as follows:

`-D`	Generate source code and copybooks into specified directories rather than the current working directory. **Note:** This is relevant to z/OS UNIX System Services only.
`-E`	Generate support for arithmetic extended types.
`-M`	Set up an alternative mapping scheme for data names.
`-O`	Override default copybook names with a different name.
`-Q`	Indicate whether single or double quotes are to be used for string literals in COBOL copybooks.
`-S`	Generate server mainline source code.
`-T`	Indicate whether server code is for batch, IMS, or CICS.
`-Z`	Generate server implementation source code.

Note: All these arguments are optional. This means that they do not have to be specified as parameters to the Orbix IDL compiler.

Specifying Compiler Arguments

Overview

This subsection describes how to specify the available arguments as parameters to the Orbix IDL compiler, both in batch and in z/OS UNIX System Services. It discusses the following topics:

- "Specifying general compiler arguments" on page 330.
- "Specifying COBOL plug-in arguments" on page 330.
- "Specifying both general and COBOL plug-in arguments" on page 331.
- "Specifying compiler arguments in batch" on page 331.
- "Specifying compiler arguments in UNIX System Services" on page 331.
- "Specifying default COBOL plug-in arguments" on page 332.

Specifying general compiler arguments

General compiler arguments are those listed in "Summary of general arguments" on page 328. These arguments must be separated by spaces. For example:

```
-Dname[=value] -E -Idir -N -Uname -u -V -v -w
```

Specifying COBOL plug-in arguments

Compiler arguments specific to the COBOL plug-in are those listed in "Summary of COBOL plug-in arguments" on page 329. They must be qualified with the `-cobol` switch. Each of these arguments must be preceded by a colon (that is, ":"), and there must be no spaces between any characters or any arguments. For example:

```
-cobol[:-D[option][dir]][:-E][:-M[option][membername]]
    [:-Omembername][:-Q[option]][:-S][:-T[option]][:-Z]
```

Specifying both general and COBOL plug-in arguments

You can specify both general and COBOL plug-in arguments together as parameters to the Orbix IDL compiler. It does not matter whether you specify general arguments first or COBOL plug-in arguments first. The main thing to remember is that:

- General arguments must be separated with spaces.
- COBOL plug-in arguments must be qualified with the `-cobol` switch, must be preceded by a colon, and must not include any spaces between any characters or arguments.

In the following example, general arguments are specified first, followed by COBOL plug-in arguments:

```
-Dname[=value] -E -Idir -N -Uname -u -V -v -w -cobol[:-D[option][dir]][:-E]
    [:-M[option][membername]][:-Omembername][:-Q[option]][:-S][:-T[option]][:-Z]
```

Specifying compiler arguments in batch

On native z/OS, to denote the arguments that you want to specify as parameters to the Orbix IDL compiler, you can use the DD name, `IDLPARM`, in the JCL that you use to run the Orbix IDL compiler. The parameters for the `IDLPARM` entry in the JCL take the following format:

```
…
// IDLPARM='-Dname[=value] -E -Idir -N -Uname -u -V -v -w -cobol[:-D[option][dir]][:-E]
    [:-M[option][membername]][:-Omembername][:-Q[option]][:-S][:-T[option]][:-Z]
…
```

See "Running the Orbix IDL Compiler" on page 316 for an example of the supplied `SIMPLIDL` JCL that is used to run the Orbix IDL compiler for the simple persistent POA-based server demonstration.

Specifying compiler arguments in UNIX System Services

The parameters to the Orbix IDL compiler take the following format on z/OS UNIX System Services:

```
-Dname[=value] -E -Idir -N -Uname -u -V -v -w -cobol[:-D[option][dir]][:-E]
    [:-M[option][membername]][:-Omembername][:-Q[option]][:-S][:-T[option]]
```

Specifying default COBOL plug-in arguments

It is possible to enable the Orbix IDL compiler to process COBOL plug-in arguments by default, without having to specify those arguments when running the Orbix IDL compiler. You can do this via settings in the `Cobol` scope of the *`orbixhlq`*`.CONFIG(IDL)` configuration member. See "Orbix IDL Compiler Configuration" on page 353 for more details.

-D Argument

Overview

By default, when you run the Orbix IDL compiler in z/OS UNIX System Services, it generates source code and copybooks into the current working directory. You can use the COBOL plug-in argument, `-D`, with the Orbix IDL compiler to redirect some or all of the generated output into alternative directories.

> **Note:** The COBOL plug-in argument, `-D`, is relevant only if you are running the Orbix IDL compiler on z/OS UNIX System Services. It is ignored if you specify it when running the Orbix IDL compiler on native z/OS.

Specifying the -D argument

The `-D` COBOL plug-in argument takes two components: a sub-argument that specifies the type of file to be redirected, and the directory path into which the file should be redirected. The three valid sub-arguments, and the file types they correspond to, are as follows:

`c` Copybooks

`m` IDL map files

`s` Source code files

You must specify the directory path directly after the sub-argument. There must be no spaces between the argument, sub-argument, and directory path. For example, consider the following command that instructs the Orbix IDL compiler to generate COBOL files based on the IDL in `myfile.idl`, and to place generated copybooks in `/home/tom/cbl/cpy` and generated source code in `/home/tom/cbl/src`:

```
idl -cobol:-Dc/home/tom/cbl/cpy:-Ds/home/tom/cbl/src myfile.idl
```

Alternatively, consider the following command that instructs the Orbix IDL compiler to generate an IDL mapping file called `myfile.map`, based on the IDL in `myfile.idl`, and to place that mapping file in `/home/tom/cbl/map`:

```
idl -cobol:Dm/home/tom/cbl/map:-Mcreate0myfile.map myfile.idl
```

Note: See the rest of this section for more details of how to generate source code and IDL mapping files.

-E Argument

Overview

The COBOL plug-in argument, `-E`, can be used to enable arithmetic extension support that is made available when the `ARITH(EXTEND)` option is used with the COBOL compiler. This `-E` option provides a direct mapping for IDL fixed types to COBOL packed-decimal types where the fixed type size is greater than 18 digits. This means that it enables Orbix Mainframe to provide support for `PICTURE S9(31) PACKED-DECIMAL` items as opposed to merely support for `PICTURE S9(18) PACKED-DECIMAL` items.

If you do not specify the `-E` COBOL plug-in argument with the Orbix IDL compiler, and the IDL fixed type definition specifies more than 18 digits, the generated data item is restricted to 18 digits. In this case, truncation of the excess most-significant digits occurs when the item is passed to COBOL, and passing data from COBOL to a fixed type with greater than 18 digits results in zero-filling of the excess most-significant digits.

Note: Use of the `-E` COBOL plug-in argument with the Orbix IDL compiler must be complemented by use of the `ARITH(EXTEND)` option with the COBOL compiler. If you specify this `-E` option to generate data items over 18 digits long, but you do not subsequently specify the `ARITH(EXTEND)` option with the COBOL compiler, the COBOL compile will result in errors.

Example of mappings with and without use of -E

For example, consider the following IDL:

```
// IDL
interface example
{
    typedef fixed<25,0> lots_of_digits;
    attribute lots_of_digits large_value;

    typedef fixed<25,8> lots_of_digits_and_prec;
    attribute lots_of_digits_and_prec large_value_prec;
};
```

By default (that is, without the use of the `-E` COBOL plug-in argument), the preceding IDL would be mapped to the following COBOL:

```
************************************************************
* Attribute:    large_value
* Mapped name:  large_value
* Type:         example/lots_of_digits (read/write)
************************************************************
01 EXAMPLE-LARGE-VALUE-ARGS.
   03 RESULT                              PICTURE S9(18)
                                          PACKED-DECIMAL.
************************************************************
* Attribute:    large_value_prec
* Mapped name:  large_value_prec
* Type:         example/lots_of_digits_and_prec (read/write)
************************************************************
01 EXAMPLE-LARGE-VALUE-PREC-ARGS.
   03 RESULT                              PICTURE S9(17)V9(1)
                                          PACKED-DECIMAL.
```

Additionally, if the IDL fixed type definition specifies more than 18 digits but you do not specify the `-E` COBOL plug-in argument, the Orbix IDL compiler issues a warning message similar to the following:

```
"idl: "DD:IDLIN(TEST)", line 19: Warning: Unsupported Type, Fixed
   type argument type, Fixed type argument too large - field size
   truncated."
```

Alternatively, if the IDL fixed type definition specifies more than 18 digits and you do specify the `-E` COBOL plug-in argument, the Orbix IDL compiler generates the following COBOL based on the preceding IDL:

```
***********************************************************
* Attribute:    large_value
* Mapped name:  large_value
* Type:         example/lots_of_digits (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-ARGS.
   03 RESULT                              PICTURE S9(25)
                                          PACKED-DECIMAL.
***********************************************************
* Attribute:    large_value_prec
* Mapped name:  large_value_prec
* Type:         example/lots_of_digits_and_prec (read/write)
***********************************************************
01 EXAMPLE-LARGE-VALUE-PREC-ARGS.
   03 RESULT                              PICTURE S9(17)V9(8)
                                          PACKED-DECIMAL.
```

-M Argument

Overview

COBOL data names generated by the Orbix IDL compiler are based on fully qualified IDL interface names by default (that is, `IDLmodulename(s)-IDLinterfacename-IDLvariablename`). You can use the `-M` argument with the Orbix IDL compiler to define your own alternative mapping scheme for data names. This is particularly useful if your COBOL data names are likely to exceed the 30-character restriction imposed by the COBOL compiler.

Example of data names generated by default

The example can be broken down as follows:

1. Consider the following IDL:

```
module Banks{
    module IrishBanks{
        interface SavingsBank{attribute short accountbal;};
        interface NationalBank{};
        interface DepositBank{};
    };
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the data names shown in Table 21 by default for the specified interfaces:

Table 21: *Example of Default Generated Data Names*

Interface Name	Generated Data Name
SavingsBank	Banks-IrishBank-SavingsBank
NationalBank	Banks-IrishBank-NationalBank
DepositBank	Banks-IrishBank-DepositBank

By using the `-M` argument, you can replace the fully scoped names shown in Table 21 with alternative data names of your choosing.

Defining IDLMAP DD card in batch

If you are running the Orbix IDL compiler in batch, and you want to specify the `-M` argument as a parameter to it, you must first define a DD card for `IDLMAP` in the JCL that you use to run the Orbix IDL compiler. This DD card specifies the PDS for the mapping member generated by the Orbix IDL compiler. For example, you might define the DD card as follows in the JCL (where *`orbixhlq`* represents the high-level qualifier for your Orbix Mainframe installation):

```
//IDLMAP    DD DISP=SHR,DSN=orbixhlq.DEMO.CBL.MAP
```

You can define a DD card for `IDLMAP` even if you do not specify the `-M` argument as a parameter to the Orbix IDL compiler. The DD card is simply ignored if the `-M` argument is not specified.

Steps to generate alternative names with the -M argument

The steps to generate alternative data name mappings with the `-M` argument are:

Step	Action
1	Run the Orbix IDL compiler with the `-Mcreate` argument, to generate the mapping member, complete with the fully qualified names and their alternative mappings.
2	Edit (if necessary) the generated mapping member, to change the alternative name mappings to the names you want to use.
3	Run the Orbix IDL compiler with the `-Mprocess` argument, to generate COBOL copybooks with the alternative data names.

Step 1—Generate the mapping member

First, you must run the Orbix IDL compiler with the `-Mcreate` argument, to generate the mapping member, which contains the fully qualified names and the alternative name mappings.

If you are running the Orbix IDL compiler in batch, the format of the command in the JCL used to run the compiler is as follows, where *`X`* represents the scope level (see "Scoping levels with the -Mcreate command" on page 340) and `BANK` is the name of the mapping member you want to create):

```
IDLPARM='-cobol:-McreateXBANK',
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the format of the command to run the compiler is as follows, where *x* represents the scope level (see "Scoping levels with the -Mcreate command" on page 340), `bank.map` is the name of the mapping file you want to create, and `myfile.idl` is the name of the IDL file:

```
-cobol:-McreateXbank.map myfile.idl
```

Note: The name of the mapping member can be up to six characters long. It you specify a name that is greater than six characters, the name is truncated to the first six characters. In the case of z/OS UNIX System Services, you do not need to assign an extension of `.map` to the mapping filename; you can choose to use any extension or assign no extension at all.

Generating mapping files into alternative directories

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the mapping file is generated by default in the working directory. If you want to place the mapping file elsewhere, use the `-Dm` argument in conjunction with the `-Mcreate` argument. For example, the following command (where *x* represents the scope level) creates a `bank.map` file based on the `myfile.idl` file, and places it in the `/home/tom/cbl/map` directory:

```
-cobol:-Dm/home/howard/cbl/map:-McreateXbank.map myfile.idl
```

See "-D Argument" on page 333 for more details about the `-D` argument.

Scoping levels with the -Mcreate command

As shown in the preceding few examples, you can specify a scope level with the `-Mcreate` command. This specifies the level of scoping to be involved in the generated data names in the mapping member. The possible scope levels are:

`0` Map fully scoped IDL names to unscoped COBOL names (that is, to the IDL variable name only).

`1` Map fully scoped IDL names to partially scoped COBOL names (that is, to *`IDLinterfacename-IDLvariablename`*). The scope operator, `/`, is replaced with a hyphen, `-`.

`2` Map fully scoped IDL names to fully scoped COBOL names (that is, to *`IDLmodulename(s)-IDLinterfacename-IDLvariablename`*). The scope operator, `/`, is replaced with a hyphen, `-`.

The following provides an example of the various scoping levels. The example can be broken down as follows:

1. Consider the following IDL:

```
module Banks{
    module IrishBanks{
        interface SavingsBank{attribute short accountbal;};
        interface NationalBank{void deposit (in long
            amount);};
    };
};
```

2. Based on the preceding IDL example, a `-Mcreate0BANK` command produces the `BANK` mapping member contents shown in Table 22.

Table 22: *Example of Level-0-Scoped Alternative Data Names*

Fully Scoped IDL Names	Generated Alternative Names
`Banks`	`Banks`
`Banks/IrishBanks`	`IrishBanks`
`Banks/IrishBanks/SavingsBank`	`SavingsBank`
`Banks/IrishBanks/SavingsBank/accountbal`	`accountbal`
`Banks/IrishBanks/NationalBank`	`NationalBank`
`Banks/IrishBanks/NationalBank/deposit`	`deposit`

Alternatively, based on the preceding IDL example, a `-Mcreate1BANK` command produces the `BANK` mapping member contents shown in Table 23.

Table 23: *Example of Level-1-Scoped Alternative Data Names*

Fully Scoped IDL Names	Generated Alternative Names
`Banks`	`Banks`
`Banks/IrishBanks`	`IrishBanks`

Table 23: *Example of Level-1-Scoped Alternative Data Names*

Fully Scoped IDL Names	Generated Alternative Names
Banks/IrishBanks/SavingsBank	SavingsBank
Banks/IrishBanks/SavingsBank/ accountbal	SavingsBanks-accountbal
Banks/IrishBanks/NationalBank	NationalBank
Banks/IrishBanks/NationalBank/ deposit	NationalBank-deposit

Alternatively, based on the preceding IDL example, a `-Mcreate2BANK` command produces the `BANK` mapping member contents shown in Table 24.

Table 24: *Example of Level-2-Scoped Alternative Data Names*

Fully Scoped IDL Names	Generated Alternative Names
Banks	Banks
Banks/IrishBanks	Banks-IrishBanks
Banks/IrishBanks/SavingsBank	Banks-IrishBanks-SavingsBank
Banks/IrishBanks/SavingsBank/ accountbal	Banks-IrishBanks-SavingsBanks- accountbal
Banks/IrishBanks/NationalBank	Banks-IrishBanks-NationalBank
Banks/IrishBanks/NationalBank/ deposit	Banks-IrishBanks-NationalBank- deposit

Note: If two or more mapped names resolve to the same name, the Orbix IDL compiler completes with a return code of 4 and outputs a warning message similar to the following:

```
idl: "dd:IDLINC(MYINTF)", line 40: Warning: name mapping clash,
my_intf/ping clases with other_intf/ping. Both map to ping
```

It is the programmer's responsibility to ensure that the mapping file is updated to ensure unique mapped names.

Step 2—Change the alternative name mappings

You can manually edit the mapping member to change the alternative names to the names that you want to use. For example, you might change the mappings in the `BANK` mapping member as follows:

Table 25: *Example of Modified Mapping Names*

Fully Scoped IDL Names	Modified Names
`Banks/IrishBanks`	`IrishBanks`
`Banks/IrishBanks/SavingsBank`	`MyBank`
`Banks/IrishBanks/NationalBank`	`MyOtherBank`
`Banks/IrishBanks/SavingsBank/accountbal`	`Myaccountbalance`

Note the following rules:

- The fully scoped name and the alternative name meant to replace it must be separated by one space (and one space only).
- If the alternative name exceeds 30 characters, it is abbreviated to 30 characters, subject to the normal COBOL mapping rules for identifiers.
- The fully scoped IDL names generated are case sensitive, so that they match the IDL being processed. If you add new entries to the mapping member, to cater for additions to the IDL, the names of the new entries must exactly match the corresponding IDL names in terms of case.

Step 3—Generate the COBOL copybooks

When you have changed the alternative mapping names as necessary, run the Orbix IDL compiler with the `-Mprocess` argument, to generate your COBOL copybooks complete with the alternative data names that you have set up in the specified mapping member.

If you are running the Orbix IDL compiler in batch, the format of the command to generate COBOL copybooks with the alternative data names is as follows (where `BANK` is the name of the mapping member you want to create):

```
IDLPARM='-cobol:-MprocessBANK'
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the format of the command to generate COBOL copybooks with the alternative data names is as follows (where `bank.map` is the name of the mapping file you want to create):

```
-cobol:-Mprocessbank.map
```

Note: If you are running the Orbix IDL compiler in z/OS UNIX System Services, and you used the `-Dm` argument with the `-Mcreate` argument, so that the mapping file is not located in the current working directory, you must specify the path to that alternative directory with the `-Mprocess` argument. For example, `-cobol:-Mprocess/home/tom/cbl/map/bank.map`.

When you run the `-Mprocess` command, your COBOL copybooks are generated with the alternative data names you want to use, instead of with the fully qualified data names that the Orbix IDL compiler generates by default.

-O Argument

Overview

COBOL source code and copybook member names generated by the Orbix IDL compiler are based by default on the IDL member name. You can use the `-O` argument with the Orbix IDL compiler to map the default source and copybook names to an alternative naming scheme, if you wish.

The `-O` argument is, for example, particularly useful for users who have migrated from Micro Focus's Orbix 2.3-based solution for z/OS, and who want to avoid having to change the `COPY` statements in their existing application source code. In this case, they can use the `-O` argument to automatically change the generated source and copybook names to the alternative names they want to use.

Note: If you are an existing user who has migrated from Micro Focus's Orbix 2.3-based solution for z/OS, see the *Mainframe Migration Guide* for more details.

Example of copybooks generated by Orbix IDL compiler

The example can be broken down as follows:

1. Consider the following IDL, where the IDL is contained in a member called `TEST`:

```
interface simple
{
     void sizeofgrid(in long mysize1, in long
         mysize2);
};

interface block
{
    void area(in long myarea);
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following COBOL copybooks, based on the IDL member name:
   - `TEST`
   - `TESTX`
   - `TESTD`

Specifying the -O argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, changes the copybook names from `TEST` to `SIMPLE`:

```
//   SOURCE=TEST
//   …
//   IDLPARM='-cobol:-OSIMPLE'
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, changes the copybook names from `TEST` to `SIMPLE`:

```
-cobol:-OSIMPLE test.idl
```

You must specify the alternative name directly after the `-O` argument (that is, no spaces). Even if you specify the replacement name in lower case (for example, `simple` instead of `SIMPLE`), the Orbix IDL compiler automatically generates replacement names in upper case.

Limitation in size of replacement name

If the name you supply as the replacement exceeds six characters (in the preceding example it does not, because it is `SIMPLE`), only the first six characters of that name are used as the basis for the alternative member names.

-Q Argument

Overview

The `-Q` argument indicates whether single or double quotes are to be used on string literals in COBOL copybooks.

Qualifying parameters

The `-Q` argument must be qualified by either `s` or `d`. If you specify `-Qs`, single quotes are used. If you specify `-Qd`, double quotes are used. If you do not specify the `-Q` argument, double quotes are used by default.

Note: By default, the copybooks supplied with your Orbix Mainframe installation use double quotes. If you want to use single quotes, see "COBOL Literal Delimiters" on page 549 for conversion details.

Specifying the -Q argument

If you are running the Orbix IDL compiler in batch, the following sample JCL specifies that single quotes are to be used on string literals in COBOL copybooks generated from the `SIMPLE` IDL member:

```
//   SOURCE=SIMPLE,
//   …
//   IDLPARM='-cobol:-Qs'
```

If you are running the Orbix IDL compiler on z/OS UNIX System Services, the following example specifies that single quotes are to be used on string literals in COBOL copybooks generated from the `simple.idl` IDL file:

```
-cobol:-Qs simple.idl
```

-S Argument

Overview

The -S argument generates server mainline source code (that is, the *idlmembername*SV member). This member is not generated by default by the Orbix IDL compiler. It is only generated if you use the -S argument, because doing so overwrites any server mainline code that has already been created based on that IDL member name.

WARNING: Only specify the -S argument if you want to generate new server mainline source code or deliberately overwrite existing code.

Specifying the -S argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, creates a server mainline member called SIMPLESV, based on the SIMPLE IDL member:

```
//   SOURCE=SIMPLE
//   …
//   IDLPARM='-cobol:-S'
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, creates a server mainline file called SIMPLESV, based on the simple.idl IDL file:

```
-cobol:-S simple.idl
```

Note: In the case of z/OS UNIX System Services, if you use the CobolExtension configuration variable to specify an extension for the server mainline source code member name, this extension is automatically appended to the generated member name. The preceding commands generate batch server mainline code. If you want to generate CICS or IMS server mainline code, see "-T Argument" on page 349 for more details.

-T Argument

Overview

The `-T` argument allows you to specify whether the server code you want to generate is for use in batch, IMS, or CICS.

Qualifying parameters

The `-T` argument must be qualified by `NATIVE`, `IMS`, or `CICS`. For example:

`NATIVE`

Specifying `-TNATIVE` with `-S` generates batch server mainline code. Specifying `-TNATIVE` with `-Z` generates batch server implementation code.

Note: Specifying `-TNATIVE` is the same as not specifying `-T` at all. That is, unless you specify `-TIMS`, the compiler generates server code by default for use in native batch mode, provided of course that you also specify `-S` or `-Z` or both.

`IMS`

Specifying `-TIMS` with `-S` generates IMS server mainline code. Specifying `-TIMS` with `-Z` generates IMS server implementation code. Specifying `-TIMS` means that the generated server output makes use of the IMS-specific `LSIMSPCB`, `WSIMSPCB`, and `UPDTPCBS` copybooks. The server implementation also uses the `WSIMSCL` copybook.

The server mainline sets pointers to the program communication block data that is in the linkage section. The pointers are kept in working storage and are defined as `EXTERNAL`, allowing the server implementation to access them. The pointers are defined in the `WSIMSPCB` copybook. The program communication block data is defined in the `LSIMSPCB` copybook. The pointers are set by using the `UPDATE-WS-PCBS` paragraph, which is defined in the `UPDTPCBS` copybook.

The server implementation maps the program communication block data defined in the linkage section using the `EXTERNAL` pointers defined in working storage (in the `WSIMSPCB` copybook). The `RETRIEVE-WS-PCBS` paragraph, which is defined in `UPDTPCBS`, is used to map the program communication block data (in the linkage section) with the pointers.

`CICS`

Specifying `-TCICS` with `-S` generates CICS server mainline code. Specifying `-TCICS` with `-Z` generates CICS server implementation code.

Specifying the -TNATIVE argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, creates a batch COBOL server mainline program (called `SIMPLESV`) and a batch COBOL server implementation program (called `SIMPLES`), based on the `SIMPLE` IDL member:

```
//    SOURCE=SIMPLE,
//    …
//    IDLPARM='-cobol:-S:-Z:-TNATIVE',
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, creates a batch COBOL server mainline program (called `SIMPLESV`) and a batch COBOL server implementation program (called `SIMPLES`), based on the `simple.idl` IDL file:

```
-cobol:-S:-Z:-TNATIVE simple.idl
```

Note: Specifying `-TNATIVE` is the same as not specifying `-T` at all.

See "Developing the Server" on page 25 for an example of batch COBOL server mainline and implementation members.

Specifying the -TIMS argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, creates an IMS COBOL server mainline program (called `SIMPLESV`) and an IMS COBOL server implementation program (called `SIMPLES`), based on the `SIMPLE` IDL member:

```
//    SOURCE=SIMPLE,
//    …
//    IDLPARM='-cobol:-S:-Z:-TIMS',
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, creates an IMS COBOL server mainline program (called `SIMPLESV`) and an IMS COBOL server implementation program (called `SIMPLES`), based on the `simple.idl` IDL file:

```
-cobol:-S:-Z:-TIMS simple.idl
```

See "Developing the IMS Server" on page 70 for an example of IMS COBOL server mainline and implementation members.

Specifying the -TCICS argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, creates a CICS COBOL server mainline member (called `SIMPLESV`) and a CICS COBOL server implementation member (called `SIMPLES`), based on the `SIMPLE` IDL member:

```
//    SOURCE=SIMPLE,
//    …
//    IDLPARM='-cobol:-S:-Z:-TCICS',
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, creates a CICS COBOL server mainline file (called `SIMPLESV`) and a CICS COBOL server implementation file (called `SIMPLES`), based on the `simple.idl` IDL file:

```
-cobol:-S:-Z:-TCICS simple.idl
```

See "Developing the CICS Server" on page 145 for an example of CICS COBOL server mainline and implementation members.

-Z Argument

Overview

The `-Z` argument generates skeleton server implementation source code (that is, the *idlmembername*S member). The generated code contains stub paragraphs for all the callable operations in the defined IDL. This member is not generated by default. It is only generated if you use the `-Z` argument, because doing so overwrites any server implementation code that has already been created based on that IDL member name.

WARNING: Only specify the `-Z` argument if you want to generate new server implementation source code or deliberately overwrite existing code.

Specifying the -Z argument

If you are running the Orbix IDL compiler in batch, the following piece of JCL, for example, creates a server implementation member called `SIMPLES`, based on the `SIMPLE` IDL member:

```
//   SOURCE=SIMPLE,
//   …
//   IDLPARM='-cobol:-Z'
```

If you are running the Orbix IDL compiler in z/OS UNIX System Services, the following command, for example, creates a server implementation file called `SIMPLES`, based on the `simple.idl` IDL file:

```
-cobol:-Z simple.idl
```

Note: In the case of z/OS UNIX System Services, if you use the `ImplementationExtension` configuration variable to specify an extension for the server implementation source code member name, this extension is automatically appended to the generated member name. The preceding commands generate batch server implementation code. If you want to generate CICS or IMS server implementation code, see "-T Argument" on page 349 for more details.

Orbix IDL Compiler Configuration

Overview

This section describes the configuration variables relevant to the Orbix IDL compiler `-cobol` plug-in for COBOL source code and copybook generation, and the `-mfa` plug-in for IMS or CICS adapter mapping member generation.

Note: The `-mfa` plug-in is not relevant for batch application development.

In this section

This section discusses the following topics:

COBOL Configuration Variables

Overview

The Orbix IDL configuration member contains settings for COBOL, along with settings for C++ and several other languages. If the Orbix IDL compiler is running in batch, it uses the configuration member located in *orbixhlq*.CONFIG(IDL). If the Orbix IDL compiler is running in z/OS UNIX System Services, it uses the configuration file specified via the IT_IDL_CONFIG_PATH export variable.

Configuration settings

The COBOL configuration is listed under Cobol as follows:

```
Cobol
{
    Switch = "cobol";
    ShlibName = "ORXBCBL";
    ShlibMajorVersion = "x";
    IsDefault = "NO";
    PresetOptions = "";

#   COBOL source and copybooks extensions
#   The default is .cbl, .xxx and .cpy on NT and none for OS/390.
    CobolExtension = "";
    ImplementationExtension = "";
    CopybookExtension = "";
};
```

Note: Settings listed with a # are considered to be comments and are not in effect. The default in relation to COBOL source and copybooks extensions is also none for z/OS UNIX System Services.

Mandatory settings

The Switch, ShlibName, and ShlibMajorVersion variables are mandatory and their default settings must not be altered. They inform the Orbix IDL compiler how to recognize the COBOL switch, and what name the DLL plug-in is stored under. The *x* value for ShlibMajorVersion represents the version number of the supplied ShlibName DLL.

User-defined settings

All but the first three settings are user-defined and can be changed. The reason for these user-defined settings is to allow you to change, if you wish, default configuration values that are set during installation. To enable a user-defined setting, use the following format.

```
setting_name = "value";
```

List of available variables

Table 26 provides an overview and description of the available configuration variables.

Table 26: *COBOL Configuration Variables (Sheet 1 of 2)*

Variable Name	Description	Default
`IsDefault`	Indicates whether COBOL is the language that the Orbix IDL compiler generates by default from IDL. If this is set to `YES`, you do not need to specify the `-cobol` switch when running the compiler.	`NO`
`PresetOptions`	The COBOL plug-in arguments that are passed by default as parameters to the Orbix IDL compiler. Any arguments specified here do not need to be specified in the JCL or on the command line when running the Orbix IDL compiler.	
`CobolExtension`[a]	Extension for the server mainline source code filename on z/OS UNIX System Services or Windows NT. **Note:** This is left blank by default, and you can set it to any value you want. The recommended setting is `.cbl`.	

Table 26: *COBOL Configuration Variables (Sheet 2 of 2)*

Variable Name	Description	Default
`ImplementationExtension`[a]	Extension for the server implementation source code filename on z/OS UNIX Systems Services or Windows NT. You should copy this to a file with a `.cbl` extension, to avoid overwriting any subsequent changes if you run the Orbix IDL compiler again. **Note:** This is left blank by default, and you can set it to any value you want. The recommended setting is `.xxx`.	
`CopybookExtension`[a]	Extension for COBOL copybook names on z/OS UNIX System Services or Windows NT. **Note:** This is left blank by default, and you can set it to any value you want. The recommended setting is `.cpy`.	
`MainCopybookSuffix`	Suffix for the main copybook member name.	
`RuntimeCopybookSuffix`	Suffix for the runtime copybook name.	`X`
`SelectCopybookSuffix`	Suffix for the select copybook member name.	`D`
`ImplementationSuffix`	Suffix for the server implementation source code member name.	`S`
`ServerSuffix`	Suffix for the server mainline source code member name.	`SV`

a. This is ignored on native z/OS.

The last five variables in Table 26 are not listed by default in `orbixhlq.CONFIG(IDL)`. If you want to change the generated member suffixes from the default values shown in Table 26, you must manually enter the relevant variable name and its corresponding value.

Adapter Mapping Member Configuration Variables

Overview

The `-mfa` plug-in allows the Orbix IDL compiler to generate:

- IMS or CICS adapter mapping members from IDL, using the `-t` argument.
- Type information members, using the `-inf` argument.

The Orbix IDL configuration member contains configuration settings relating to the generation of IMS or CICS adapter mapping members and type information members.

> **Note:** See the *IMS Adapter Administrator's Guide* or *CICS Adapter Administrator's Guide* for more details about adapter mapping members and type information members.

Configuration settings

The IMS or CICS adapter mapping member configuration is listed under `MFAMappings` as follows:

```
MFAMappings
{
      Switch = "mfa";
      ShlibName = "ORXBMFA";
      ShlibMajorVersion = "x";
      IsDefault = "NO";
      PresetOptions = "";

#     Mapping & Type Info file suffix and ext. may be overridden
#     The default mapping file suffix is A
#     The default mapping file ext. is .map and none for OS/390
#     The default type info file suffix is B
#     The default type info file ext. is .inf and none for OS/390
#     MFAMappingExtension   = "";
#     MFAMappingSuffix      = "";
#     TypeInfoFileExtension = ""'
#     TypeInfoFileSuffix    = "";
};
```

Mandatory settings

The `Switch`, `ShlibName`, and `ShlibMajorVersion` variables are mandatory and their settings must not be altered. They inform the Orbix IDL compiler how to recognize the adapter mapping member switch, and what name the DLL plug-in is stored under. The *x* value for `ShlibMajorVersion` represents the version number of the supplied `ShlibName` DLL.

User-defined settings

All but the first three settings are user-defined and can be changed. The reason for these user-defined settings is to allow you to change, if you wish, default configuration values that are set during installation. To enable a user-defined setting, use the following format.

```
setting_name = "value";
```

List of available variables

Table 27 provides an overview and description of the available configuration variables.

Table 27: *Adapter Mapping Member Configuration Variables*

Variable Name	Description	Default
`IsDefault`	Indicates whether the Orbix IDL compiler generates adapter mapping members by default from IDL. If this is set to `YES`, you do not need to specify the `-mfa` switch when running the compiler.	
`PresetOptions`	The COBOL plug-in arguments that are passed by default as parameters to the Orbix IDL compiler for the purposes of generating adapter mapping members. Any arguments specified here do not need to be specified in the JCL or on the command line when running the Orbix IDL compiler.	

Table 27: *Adapter Mapping Member Configuration Variables*

Variable Name	Description	Default
`MFAMappingExtension`[a]	Extension for the adapter mapping filename on z/OS UNIX System Services and Windows NT.	`map`
`MFAMappingSuffix`	Suffix for the adapter mapping member name. If you do not specify a value for this, it is generated with an `A` suffix by default.	`A`
`TypeInfoFileExtensiona`	Extension for the type information filename on z/OS UNIX System Services and Windows NT.	`inf`
`TypeInfoFileSuffix`	Suffix for the type information member name. If you do not specify a value for this, it is generated with a `B` suffix by default.	`B`

a. This is ignored on native z/OS.

Providing Arguments to the IDL Compiler

Overview

The Orbix IDL compiler configuration can be used to provide arguments to the IDL compiler. Normally, IDL compiler arguments are supplied to the `ORXIDL` procedure via the `IDLPARM` JCL symbolic, which comprises part of the JCL PARM. The JCL PARM has a 100-character limit imposed by the operating system. Large IDL compiler arguments, coupled with locale environment variables, tend to easily approach or exceed the 100-character limit. To help avoid problems with the 100-character limit, IDL compiler arguments can be provided via a data set containing IDL compiler configuration statements.

IDL compiler argument input to ORXIDL

The `ORXIDL` procedure accepts IDL compiler arguments from three sources:

- The *`orbixhlq`*`.CONFIG(IDL)` data set—This is the main Orbix IDL compiler configuration data set. See "COBOL Configuration Variables" on page 354 for an example of the `Cobol` configuration scope. See "Adapter Mapping Member Configuration Variables" on page 358 for an example of the `MFAMappings` configuration scope. The `Cobol` and `MFAMappings` configuration scopes used by the IDL compiler are in *`orbixhlq`*`.CONFIG(IDL)`. IDL compiler arguments are specified in the `PresetOptions` variable.
- The `IDLARGS` data set—This data set can extend or override what is defined in the main Orbix IDL compiler configuration data set. The `IDLARGS` data set defines a `PresetOptions` variable for each configuration scope. This variable overrides what is defined in the main Orbix IDL compiler configuration data set.
- The `IDLPARM` symbolic of the `ORXIDL` procedure—This is the usual source of IDL compiler arguments.

Because the `IDLPARM` symbolic is the usual source for IDL compiler arguments, it might lead to problems with the 100-character JCL PARM limit. Providing IDL compiler arguments in the `IDLARGS` data set can help to avoid problems with the 100-character limit. If the same IDL compiler arguments are supplied in more than one input source, the order of precedence is as follows:

- IDL compiler arguments specified in the `IDLPARM` symbolic take precedence over identical arguments specified in the `IDLARGS` data set and the main Orbix IDL compiler configuration data set.
- The `PresetOptions` variable in the `IDLARGS` data set overrides the `PresetOptons` variable in the main Orbix IDL compiler configuration data set. If a value is specified in the `PresetOptons` variable in the main Orbix IDL compiler configuration data set, it should be defined (along with any additional IDL compiler arguments) in the `PresetOptions` variable in the `IDLARGS` data set.

Using the IDLARGS data set

The `IDLARGS` data set can help when IDL compiles are failing due to the 100-character limit of the JCL PARM. Consider the following JCL:

```
//IDLCBL      EXEC ORXIDL,
//            SOURCE=BANKDEMO,
//            IDL=&ORBIX..DEMO.IDL,
//            COPYLIB=&ORBIX..DEMO.CBL.COPYLIB,
//            IMPL=&ORBIX..DEMO.CBL.SRC,
//            IDLPARM='-cobol:-MprocessBANK:-OBANK'
```

In the preceding example, all the IDL compiler arguments are provided in the `IDLPARM` JCL symbolic, which is part of the JCL PARM. The JCL PARM can also be comprised of an environment variable that specifies locale information. Locale environment variables tend to be large and use up many of the 100 available characters in the JCL PARM. If the 100-character limit is exceeded, some of the data in the IDLPARM JCL symbolic can be moved to the IDLARGS data set to reclaim some of the JCL PARM space. The preceding example can be recoded as follows:

```
//IDLCBL      EXEC ORXIDL,
//            SOURCE=BANKDEMO,
//            IDL=&ORBIX..DEMO.IDL,
//            COPYLIB=&ORBIX..DEMO.CBL.COPYLIB,
//            IMPL=&ORBIX..DEMO.CBL.SRC,
//            IDLPARM='-cobol'
//IDLARGS     DD *
 Cobol {PresetOptions = "-MprocessBANK:-OBANK";];
/*
```

The IDLPARM JCL symbolic retains the -cobol switch. The rest of the IDLPARM data is now provided in the IDLARGS data set, freeing up 21 characters of JCL PARM space.

The IDLARGS data set contains IDL configuration file scopes. These are a reopening of the scopes defined in the main IDL configuration file. In the preceding example, the IDLPARM JCL symbolic contains a -cobol switch. This instructs the IDL compiler to look in the Cobol scope of the IDLARGS dataset for any IDL compiler arguments that might be defined in the PresetOptions variable. Based on the preceding example, it finds -MprocessBANK:-OBANK.

The IDLARGS data set must be coded according to the syntax rules for the main Orbix IDL compiler configuration data set. See "COBOL Configuration Variables" on page 354 for an example of the Cobol configuration scope. See "Adapter Mapping Member Configuration Variables" on page 358 for an example of the MFAMappings configuration scope.

Note: A long entry can be continued by coding a backslash character (that is, \) in column 72, and starting the next line in column 1.

Defining multiple scopes in the IDLARGS data set

The `IDLARGS` data set can contain multiple scopes. Consider the following JCL that compiles IDL for a CICS server:

```
//IDLCBL      EXEC ORXIDL,
//            SOURCE=NSTSEQ,
//            IDL=&ORBIX..DEMO.IDL,
//            COPYLIB=&ORBIX..DEMO.CICS.CBL.COPYLIB,
//            IMPL=&ORBIX..DEMO.CICS.CBL.SRC,
//            IDLPARM='-cobol:-S:-TCICS -mfa:-tNSTSEQSV'
```

The `IDLPARM` JCL symbolic contains both a `-cobol` and `-mfa` switch. The preceding example can be recoded as follows:

```
//IDLCBL      EXEC ORXIDL,
//            SOURCE=NSTSEQ,
//            IDL=&ORBIX..DEMO.IDL,
//            COPYLIB=&ORBIX..DEMO.CICS.CBL.COPYLIB,
//            IMPL=&ORBIX..DEMO.CICS.CBL.SRC,
//            IDLPARM='-cobol -mfa'
//IDLARGS     DD *
Cobol {PresetOptions = "-S:-TCICS";};
MFAMappings {PresetOptions = "-tNSTSEQSV";};
/*
```

The `IDLPARM` JCL symbolic retains the `-cobol` and `-mfa` IDL compiler switches. The IDL compiler looks for `-cobol` switch arguments in the `Cobol` scope, and for `-mfa` switch arguments in the `MFAMappings` scope.

Memory Handling

Memory handling must be performed when using dynamic structures such as unbounded strings, unbounded sequences, and anys. This chapter provides details of responsibility for the allocation and subsequent release of dynamic memory for these complex types at the various stages of an Orbix COBOL application. It first describes in detail the memory handling rules adopted by the COBOL runtime for operation parameters relating to different dynamic structures. It then provides a type-specific breakdown of the APIs that are used to allocate and release memory for these dynamic structures.

In this chapter

This chapter discusses the following topics:

Note: See "API Reference" on page 405 for full API details.

Operation Parameters

Overview

This section describes in detail the memory handling rules adopted by the COBOL runtime for operation parameters relating to different types of dynamic structures, such as unbounded strings, bounded and unbounded sequences, and `any` types. Memory handling must be performed when using these dynamic structures. It also describes memory issues arising from the raising of exceptions.

In this section

The following topics are discussed in this section:

Unbounded Sequences and Memory Management

Overview for IN parameters

Table 28 provides a detailed outline of how memory is handled for unbounded sequences that are used as `in` parameters.

Table 28: *Memory Handling for IN Unbounded Sequences*

Client Application	Server Application
1. SEQALLOC	
2. SEQSET[a]	
3. ORBEXEC—(send)	
	4. COAGET—(receive, allocate)
	5. SEQGET
	6. COAPUT—(free)
7. SEQFREE	

a. SEQSET performs a deep copy from element buffer into the sequence. This means that if an element buffer contains dynamic data (for example, a string or sequence), the element buffer should be freed after calling SEQSET, to prevent memory leaks. Memory should be handled as follows for an unbounded sequence of strings, to prevent a leak:
1. Call STRSET to allocate an element in the element buffer.
2. Call SEQSET to copy the element into the sequence.
3. Call STRFREE to free the element buffer.

Summary of rules for IN parameters

The memory handling rules for an unbounded sequence used as an `in` parameter can be summarized as follows, based on Table 28:

1. The client calls `SEQALLOC` to initialize the sequence information block and allocate memory for both the sequence information block and the sequence data.
2. The client calls `SEQSET` to initialize the sequence elements.
3. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the values across the network.
4. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the sequence and implicitly allocate memory for it.
5. The server calls `SEQGET` to obtain the sequence value from the operation parameter buffer.

6. The server calls `COAPUT`, which causes the server-side COBOL runtime to implicitly free the memory allocated by the call to `COAGET`.
7. The client calls `SEQFREE` to free the memory allocated by the call to `SEQALLOC`.

Overview for INOUT parameters

Table 29 provides a detailed outline of how memory is handled for unbounded sequences that are used as `inout` parameters.

Table 29: *Memory Handling for INOUT Unbounded Sequences*

Client Application	Server Application
1. SEQALLOC 2. SEQSET[a] 3. ORBEXEC—(send)	
	4. COAGET—(receive, allocate) 5. SEQGET 6. SEQFREE 7. SEQALLOC 8. SEQSET 9. COAPUT—(send, free)
10. (free, receive, allocate) 11. SEQGET 12. SEQFREE	

a. SEQSET performs a deep copy from element buffer into the sequence. This means that if an element buffer contains dynamic data (for example, a string or sequence), the element buffer should be freed after calling SEQSET, to prevent memory leaks. Memory should be handled as follows for an unbounded sequence of strings, to prevent a leak:
1. Call STRSET to allocate an element in the element buffer.
2. Call SEQSET to copy the element into the sequence.
3. Call STRFREE to free the element buffer.

Summary of rules for INOUT parameters

The memory handling rules for an unbounded sequence used as an `inout` parameter can be summarized as follows, based on Table 29:

1. The client calls `SEQALLOC` to initialize the sequence information block and allocate memory for both the sequence information block and the sequence data.
2. The client calls `SEQSET` to initialize the sequence elements.

3. The client calls ORBEXEC, which causes the client-side COBOL runtime to marshal the values across the network.
4. The server calls COAGET, which causes the server-side COBOL runtime to receive the sequence and implicitly allocate memory for it.
5. The server calls SEQGET to obtain the sequence value from the operation parameter buffer.
6. The server calls SEQFREE to explicitly free the memory allocated for the original in sequence via the call to COAGET in point 4.
7. The server calls SEQALLOC to initialize the replacement out sequence and allocate memory for both the sequence information block and the sequence data.
8. The server calls SEQSET to initialize the sequence elements for the replacement out sequence.
9. The server calls COAPUT, which causes the server-side COBOL runtime to marshal the replacement out sequence across the network and then implicitly free the memory allocated for it via the call to SEQALLOC in point 7.
10. Control returns to the client, and the call to ORBEXEC in point 3 now causes the client-side COBOL runtime to:
    i. Free the memory allocated for the original in sequence via the call to SEQALLOC in point 1.
    ii. Receive the replacement out sequence.
    iii. Allocate memory for the replacement out sequence.

    Note: By having ORBEXEC free the originally allocated memory before allocating the replacement memory means that a memory leak is avoided.

11. The client calls SEQGET to obtain the sequence value from the operation parameter buffer.
12. The client calls SEQFREE to free the memory allocated for the replacement out sequence in point 10 via the call to ORBEXEC in point 3.

Overview for OUT and return parameters

Table 30 provides a detailed outline of how memory is handled for unbounded sequences that are used as `out` or `return` parameters.

Table 30: *Memory Handling for OUT and Return Unbounded Sequences*

Client Application	Server Application
1. ORBEXEC—(send)	
	2. COAGET—(receive) 3. SEQALLOC 4. SEQSET[a] 5. COAPUT—(send, free)
6. (receive, allocate) 7. SEQGET 8. SEQFREE	

a. SEQSET performs a deep copy from element buffer into the sequence. This means that if an element buffer contains dynamic data (for example, a string or sequence), the element buffer should be freed after calling SEQSET, to prevent memory leaks. Memory should be handled as follows for an unbounded sequence of strings, to prevent a leak:
1. Call STRSET to allocate an element in the element buffer.
2. Call SEQSET to copy the element into the sequence.
3. Call STRFREE to free the element buffer.

Summary of rules for OUT and return parameters

The memory handling rules for an unbounded sequence used as an `out` or `return` parameter can be summarized as follows, based on Table 30:

1. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the request across the network.
2. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the client request.
3. The server calls `SEQALLOC` to initialize the sequence and allocate memory for both the sequence information block and the sequence data.
4. The server calls `SEQSET` to initialize the sequence elements.
5. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the values across the network and implicitly free the memory allocated to the sequence via the call to `SEQALLOC`.

6. Control returns to the client, and the call to ORBEXEC in point 1 now causes the client-side COBOL runtime to receive the sequence and implicitly allocate memory for it.
7. The client calls SEQGET to obtain the sequence value from the operation parameter buffer.
8. The client calls SEQFREE, which causes the client-side COBOL runtime to free the memory allocated for the sequence via the call to ORBEXEC.

Unbounded Strings and Memory Management

Overview for IN parameters

Table 31 provides a detailed outline of how memory is handled for unbounded strings that are used as `in` parameters.

Table 31: *Memory Handling for IN Unbounded Strings*

Client Application	Server Application
1. STRSET 2. ORBEXEC—(send) 6. STRFREE	 3. COAGET—(receive, allocate) 4. STRGET 5. COAPUT—(free)

Summary of rules for IN parameters

The memory handling rules for an unbounded string used as an `in` parameter can be summarized as follows, based on Table 31:

1. The client calls `STRSET` to initialize the unbounded string and allocate memory for it.
2. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the values across the network.
3. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the string and implicitly allocate memory for it.
4. The server calls `STRGET` to obtain the string value from the operation parameter buffer.
5. The server calls `COAPUT`, which causes the server-side COBOL runtime to implicitly free the memory allocated by the call to `COAGET`.
6. The client calls `STRFREE` to free the memory allocated by the call to `STRSET`.

Overview for INOUT parameters

Table 32 provides a detailed outline of how memory is handled for unbounded strings that are used as `inout` parameters.

Table 32: *Memory Handling for INOUT Unbounded Strings*

Client Application	Server Application
1. STRSET 2. ORBEXEC—(send) 8. (free, receive, allocate) 9. STRGET 10. STRFREE	 3. COAGET—(receive, allocate) 4. STRGET 5. STRFREE 6. STRSET 7. COAPUT—(send, free)

Summary of rules for INOUT parameters

The memory handling rules for an unbounded string used as an `inout` parameter can be summarized as follows, based on Table 32:

1. The client calls `STRSET` to initialize the unbounded string and allocate memory for it.
2. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the values across the network.
3. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the string and implicitly allocate memory for it.
4. The server calls `STRGET` to obtain the string value from the operation parameter buffer.
5. The server calls `STRFREE` to explicitly free the memory allocated for the original `in` string via the call to `COAGET` in point 3.
6. The server calls `STRSET` to initialize the replacement `out` string and allocate memory for it.
7. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the replacement `out` string across the network and then implicitly free the memory allocated for it via the call to `STRSET` in point 6.

8. Control returns to the client, and the call to `ORBEXEC` in point 2 now causes the client-side COBOL runtime to:
   i. Free the memory allocated for the original `in` string via the call to `STRSET` in point 1.
   ii. Receive the replacement `out` string.
   iii. Allocate memory for the replacement `out` string.

   Note: By having `ORBEXEC` free the originally allocated memory before allocating the replacement memory means that a memory leak is avoided.

9. The client calls `STRGET` to obtain the replacement `out` string value from the operation parameter buffer.
10. The client calls `STRFREE` to free the memory allocated for the replacement `out` string in point 8 via the call to `ORBEXEC` in point 2.

Overview for OUT and return parameters

Table 33 provides a detailed outline of how memory is handled for unbounded strings that are used as `out` or `return` parameters.

Table 33: *Memory Handling for OUT and Return Unbounded Strings*

Client Application	Server Application
1. ORBEXEC—(send)	
	2. COAGET—(receive) 3. STRSET 4. COAPUT—(send, free)
5. (receive, allocate) 6. STRGET 7. STRFREE	

Summary of rules for OUT and return parameters

The memory handling rules for an unbounded string used as an `out` or `return` parameter can be summarized as follows, based on Table 33:

1. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the request across the network.
2. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the client request.

3. The server calls `STRSET` to initialize the string and allocate memory for it.
4. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the values across the network and implicitly free the memory allocated to the string via the call to `STRSET`.
5. Control returns to the client, and the call to `ORBEXEC` in point 1 now causes the client-side COBOL runtime to receive the string and implicitly allocate memory for it.
6. The client calls `STRGET` to obtain the string value from the operation parameter buffer.
7. The client calls `STRFREE`, which causes the client-side COBOL runtime to free the memory allocated for the string in point 5 via the call to `ORBEXEC` in point 1.

Object References and Memory Management

Overview for IN parameters

Table 34 provides a detailed outline of how memory is handled for object references that are used as `in` parameters.

Table 34: *Memory Handling for IN Object References*

Client Application	Server Application
1. Attain object reference 2. ORBEXEC—(send) 6. OBJREL	 3. COAGET—(receive) 4. read 5. COAPUT

Summary of rules for IN parameters

The memory handling rules for an object reference used as an `in` parameter can be summarized as follows, based on Table 34:

1. The client attains an object reference through some retrieval mechanism (for example, by calling `STRTOOBJ` or `OBJRIR`).
2. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the object reference across the network.
3. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the object reference.
4. The server can now invoke on the object reference.
5. The server calls `COAPUT`, which causes the server-side COBOL runtime to implicitly free any memory allocated by the call to `COAGET`.
6. The client calls `OBJREL` to release the object.

Overview for INOUT parameters

Table 35 provides a detailed outline of how memory is handled for object references that are used as `inout` parameters.

Table 35: *Memory Handling for INOUT Object References*

Client Application	Server Application
1. Attain object reference 2. ORBEXEC—(send)	
	3. COAGET—(receive) 4. read 5. OBJREL 6. Attain object reference 7. OBJDUP 8. COAPUT—(send)
9. (receive) 10. read 11. OBJREL	

Summary of rules for INOUT parameters

The memory handling rules for an object reference used as an `inout` parameter can be summarized as follows, based on Table 35:

1. The client attains an object reference through some retrieval mechanism (for example, by calling `STRTOOBJ` or `OBJRIR`).
2. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the object reference across the network.
3. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the object reference.
4. The server can now invoke on the object reference.
5. The server calls `OBJREL` to release the original `in` object reference.
6. The server attains an object reference for the replacement `out` parameter through some retrieval mechanism (for example, by calling `STRTOOBJ` or `OBJRIR`).
7. The server calls `OBJDUP` to increment the object reference count and to prevent the call to `COAPUT` in point 8 from causing the replacement `out` object reference to be released.
8. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the replacement `out` object reference across the network.

9. Control returns to the client, and the call to `ORBEXEC` in point 2 now causes the client-side COBOL runtime to receive the replacement `out` object reference.
10. The client can now invoke on the replacement object reference.
11. The client calls `OBJREL` to release the object.

Overview for OUT and return parameters

Table 36 provides a detailed outline of how memory is handled for object references that are used as `out` or `return` parameters.

Table 36: *Memory Handling for OUT and Return Object References*

Client Application	Server Application
1. ORBEXEC—(send)	
	2. COAGET—(receive) 3. Attain object reference 4. OBJDUP 5. COAPUT—(send)
6. (receive) 7. read 8. OBJREL	

Summary of rules for OUT and return parameters

The memory handling rules for an object reference used as an `out` or `return` parameter can be summarized as follows, based on Table 36:

1. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the request across the network.
2. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the client request.
3. The server attains an object reference through some retrieval mechanism (for example, by calling `STRTOOBJ` or `OBJRIR`).
4. The server calls `OBJDUP` to increment the object reference count and to prevent the call to `COAPUT` in point 5 from causing the object reference to be released.
5. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the object reference across the network.
6. Control returns to the client, and the call to `ORBEXEC` in point 1 now causes the client-side COBOL runtime to receive the object reference.

7. The client can now invoke on the object reference.
8. The client calls `OBJREL` to release the object.

The any Type and Memory Management

Overview for IN parameters

Table 37 provides a detailed outline of how memory is handled for an `any` type that is used as an `in` parameter.

Table 37: *Memory Handling for IN Any Types*

Client Application	Server Application
1. TYPESET 2. ANYSET 3. ORBEXEC—(send)	
	4. COAGET—(receive, allocate) 5. TYPEGET 6. ANYGET 7. COAPUT—(free)
8. ANYFREE	

Summary of rules for IN parameters

The memory handling rules for an `any` type used as an `in` parameter can be summarized as follows, based on Table 37:

1. The client calls `TYPESET` to set the type of the `any`.
2. The client calls `ANYSET` to set the value of the `any` and allocate memory for it.
3. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the values across the network.
4. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the `any` value and implicitly allocate memory for it.
5. The server calls `TYPEGET` to obtain the typecode of the `any`.
6. The server calls `ANYGET` to obtain the value of the `any` from the operation parameter buffer.
7. The server calls `COAPUT`, which causes the server-side COBOL runtime to implicitly free the memory allocated by the call to `COAGET`.
8. The client calls `ANYFREE` to free the memory allocated by the call to `ANYSET`.

Overview for INOUT parameters

Table 38 provides a detailed outline of how memory is handled for an `any` type that is used as an `inout` parameter.

Table 38: *Memory Handling for INOUT Any Types*

Client Application	Server Application
1. TYPESET 2. ANYSET 3. ORBEXEC—(send)	
	4. COAGET—(receive, allocate) 5. TYPEGET 6. ANYGET 7. ANYFREE 8. TYPSET 9. ANYSET 10. COAPUT—(send, free)
11. (free, receive, allocate) 12. TYPEGET 13. ANYGET 14. ANYFREE	

Summary of rules for INOUT parameters

The memory handling rules for an `any` type used as an `inout` parameter can be summarized as follows, based on Table 38:

1. The client calls `TYPESET` to set the type of the `any`.
2. The client calls `ANYSET` to set the value of the `any` and allocate memory for it.
3. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the values across the network.
4. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the `any` value and implicitly allocate memory for it.
5. The server calls `TYPEGET` to obtain the typecode of the `any`.
6. The server calls `ANYGET` to obtain the value of the `any` from the operation parameter buffer.
7. The server calls `ANYFREE` to explicitly free the memory allocated for the original `in` value via the call to `COAGET` in point 4.
8. The server calls `TYPESET` to set the type of the replacement `any`.

9. The server calls `ANYSET` to set the value of the replacement `any` and allocate memory for it.
10. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the replacement `any` value across the network and then implicitly free the memory allocated for it via the call to `ANYSET` in point 9.
11. Control returns to the client, and the call to `ORBEXEC` in point 3 now causes the client-side COBOL runtime to:
    i. Free the memory allocated for the original `any` via the call to `ANYSET` in point 2.
    ii. Receive the replacement `any`.
    iii. Allocate memory for the replacement `any`.

    Note: By having `ORBEXEC` free the originally allocated memory before allocating the replacement memory means that a memory leak is avoided.

12. The client calls `TYPEGET` to obtain the typecode of the replacement `any`.
13. The client calls `ANYGET` to obtain the value of the replacement `any` from the operation parameter buffer.
14. The client calls `ANYFREE` to free the memory allocated for the replacement `out` string in point 11 via the call to `ORBEXEC` in point 3.

Overview for OUT and return parameters

Table 39 provides a detailed outline of how memory is handled for an `any` type that is used as an `out` or `return` parameter.

Table 39: *Memory Handling for OUT and Return Any Types*

Client Application	Server Application
1. ORBEXEC—(send)	
	2. COAGET—(receive) 3. TYPESET 4. ANYSET 5. COAPUT—(send, free)
6. (receive, allocate) 7. TYPEGET 8. ANYGET 9. ANYFREE	

Summary of rules for OUT and return parameters

The memory handling rules for an `any` type used as an `out` or `return` parameter can be summarized as follows, based on Table 39:

1. The client calls `ORBEXEC`, which causes the client-side COBOL runtime to marshal the request across the network.
2. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the client request.
3. The server calls `TYPESET` to set the type of the `any`.
4. The server calls `ANYSET` to set the value of the `any` and allocate memory for it.
5. The server calls `COAPUT`, which causes the server-side COBOL runtime to marshal the values across the network and implicitly free the memory allocated to the `any` via the call to `ANYSET`.
6. Control returns to the client, and the call to `ORBEXEC` in point 1 now causes the client-side COBOL runtime to receive the `any` and implicitly allocate memory for it.
7. The client calls `TYPEGET` to obtain the typecode of the `any`.
8. The client calls `ANYGET` to obtain the value of the `any` from the operation parameter buffer.

9. The client calls `ANYFREE`, which causes the client-side COBOL runtime to free the memory allocated for the `any` in point 6 via the call to `ORBEXEC` in point 1.

User Exceptions and Memory Management

Overview

Table 40 provides a detailed outline of how memory is handled for user exceptions.

Table 40: *Memory Handling for User Exceptions*

Client Application	Server Application
1. ORBEXEC—(send)	
	2. COAGET—(receive, allocate) 3. write 4. COAERR 5. (free)
6. *Free*	

Summary of rules

The memory handling rules for raised user exceptions can be summarized as follows, based on Table 40:

1. The client calls `ORBEXEC`, which causes the COBOL runtime to marshal the client request across the network.
2. The server calls `COAGET`, which causes the server-side COBOL runtime to receive the client request and allocate memory for any arguments (if necessary).
3. The server initializes the user exception block with the information for the exception to be raised.
4. The server calls `COAERR`, to raise the user exception.
5. The server-side COBOL runtime automatically frees the memory allocated for the user exception in point 3.

> **Note:** The COBOL runtime does not, however, free the argument buffers for the user exception. To prevent a memory leak, it is up to the server program to explicitly free active argument structures, regardless of whether they have been allocated automatically by the COBOL runtime or allocated manually. This should be done before the server calls `COAERR`.

6. The client must explicitly free the exception ID in the user exception header, by calling `STRFREE`. It must also free any exception data mapping to dynamic structures (for example, if the user exception information block contains a sequence, this can be freed by calling `SEQFREE`).

Memory Management Routines

Overview

This section provides examples of COBOL routines for allocating and freeing memory for various types of dynamic structures. These routines are necessary when sending arguments across the wire or when using user-defined IDL types as variables within COBOL.

Unbounded strings

Use `STRSET` to allocate memory for unbounded strings, and `STRFREE` to subsequently free this memory. For example:

```
01 MY-COBOL-STRING          PICTURE X(11) VALUE "Testing 123".
01 MY-COBOL-STRING-LEN      PIC 9(09) BINARY VALUE 11.
01 MY-CORBA-STRING          POINTER VALUE NULL.

* Allocation
CALL "STRSET"    USING MY-CORBA-STRING
                       MY-COBOL-STRING-LEN
                       MY-CORBA-STRING.
* Deletion
CALL "STRFREE"   USING MY-CORBA-STRING.
```

Note: Unbounded strings are stored internally as normal C or C++ strings that are terminated by a null character. The `STRx` routines provide facilities for copying these strings without the null character. The `STRx` routines also provide facilities for correctly truncating and padding the strings to and from their COBOL equivalents. It can be useful to know exactly how big the string actually is before copying it. You can use the `STRLEN` function to obtain this information.

Unbounded wide strings

Use `WSTRSET` to allocate memory for unbounded wide strings, and `WSTRFRE` to subsequently free this memory. For example:

```
01 MY-CORBA-WSTRING          POINTER VALUE NULL.

* Allocation
CALL "WSTRSET    USING MY-CORBA-WSTRING
                       MY-COBOL-WSTRING-LEN
                       MY-CORBA-WSTRING.
* Deletion
CALL "WSTRFREE"  USING MY-CORBA-WSTRING.
```

Typecodes

As described in the Mapping chapter, typecodes are mapped to a pointer. They are handled in COBOL as unbounded strings and should contain a value corresponding to one of the typecode keys generated by the Orbix IDL compiler. For example:

```
01 MY-TYPECODE               POINTER VALUE NULL.

* Allocation
CALL "STRSET"    USING MY-TYPECODE
                       MY-COMPLEX-TYPE
                       MY-COMPLEX-TYPE-LENGTH.
* Deletion
CALL "STRFREE"   USING MY-TYPECODE.
```

Unbounded sequences

Use `SEQALLOC` to initialize an unbounded sequence. This dynamically creates a sequence information block that is used internally to record state, and allocates the memory required for sequence elements.

You can use `SEQSET` and `SEQGET` to access the sequence elements. If an attempt is made to add an element beyond the maximum size of the sequence, `SEQSET` automatically resizes the sequence for you by adding 1024 elements to the sequence maximum. If the sequence size grows larger than 8K, the resize amount is calculated as follows:
sequence maximum + (*1/8* * *current sequence maximum*).

Note: Additional overhead is incurred by your application each time a resize occurs. This is because an allocation, a copy, and a free occur each time. The larger your sequence, the larger your overhead. To avoid this overhead, ensure you specify the sequence maximum in your application.

Use SEQFREE to free memory allocated via SEQALLOC. For example:

```
* Allocation
CALL "SEQALLOC"   USING MY-SEQUENCE-MAXIMUM
                        MY-USEQ-TYPE
                        MY-USEQ-TYPE-LENGTH
                        N-SEQUENCE OF MY-USEQ-ARGS.
* Deletion
CALL "SEQFREE"    USING N-SEQUENCE OF MY-USEQ-ARGS.
```

Note: You only need to call SEQFREE on the outermost sequence, because it automatically deletes both the sequence information block and any associated inner dynamic structures.

The any type

Use TYPESET to initialize the any information status block and allocate memory for it. Then use ANYSET to set the type of the any. Use ANYFREE to free memory allocated via TYPESET. This frees the flat structure created via TYPESET and any dynamic structures that are contained within it. For example:

```
01 MY-CORBA-ANY         POINTER VALUE NULL.
01 MY-LONG              PIC 9(10) BINARY VALUE 123.
* Allocation
SET CORBA-TYPE-LONG TO TRUE.
CALL "TYPESET"   USING MY-CORBA-ANY
                       MY-COMPLEX-TYPE-LENGTH
                       MY-COMPLEX-TYPE.

CALL "ANYSET"    USING MY-CORBA-ANY
                       MY-LONG.

* Deletion
CALL "ANYFREE"    USING MY-CORBA-ANY.
```

Common Memory Management Tasks

Overview

This section provides some worked solutions for common tasks that involve memory management. It describes how to implement a client that invokes upon a factory object to retrieve a worker object, which it then invokes upon.

IDL

This worked solution describes the code required for a client to invoke upon a factory object. The following is the sample IDL for the server:

```
interface Worker {
     void runMe();
};

interface TestFactory {
     Worker createWorker(in string testid);
     Worker findWorker(in string testid);
     Void removeWorker(in string testid);
};
```

Client mainline (initialization)

The client obtains an object reference to the `TestFactory` factory object in the usual way (that is, from a file, or the Naming Service, or an IOR). For example:

```
…
     MOVE "IOR:…" TO WS-FACTORY-OBJ-IOR.

* Convert the COBOL string to a CORBA string for
* use via STRTOOBJ
     CALL "STRSET"    USING IOR-REC-PTR
                            IOR-REC-LEN
                            WS-FACTORY-OBJ-IOR.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

* Obtain object reference from the IOR
     CALL "STRTOOBJ"   USING IOR-REC-PTR
                             FACTORY-OBJ
     SET WS-STRTOOBJ TO TRUE.
     PERFORM CHECK-STATUS.
```

```
* Release the CORBA string as we now have an
* object reference
     CALL "STRFREE"    USING IOR-REC-PTR.
     SET WS-STRFREE TO TRUE.
     PERFORM CHECK-STATUS.
…
```

Client mainline (main body)

Given a reference to the factory object, a client will typically:

1. Retrieve a reference to a worker object.
2. Invoke on the worker object.
3. Clean up.

For the purposes of this sample solution, the rest of the client mainline looks as follows:

```
…
     PERFORM CREATE-WORKER.
     PERFORM INVOKE-WORKER.
     PERFORM DESTORY-WORKER.

* Clean up factory object
     CALL "OBJREL" USING FACTORY-OBJ.
     SET WS-OBJREL TO TRUE.
     PERFORM CHECK-STATUS.

     DISPLAY "Object Factory demo complete.".

     PERFORM EXIT-PRG.
```

Creating a worker

The implementation of `CREATE-WORKER` should invoke upon the `TestFactory.createWorker()` method. This method requires a CORBA string as input (a key by which the worker object is identified) and returns an object reference for the resulting worker object.

To invoke upon the `createWorker` method, some Working Storage methods are required to instantiate the CORBA string, and also to represent the worker object reference in memory:

```
01 WORKER-ID-PTR                  POINTER VALUE NULL.
01 WORKER-ID-LENGTH               PICTURE 9(09) BINARY.
01 WORKER-ID-STRING               PICTURE X(20).
01 WORKER-OBJECT-REF              POINTER.
```

The code for CREATE-WORKER then looks as follows:

```
 CREATE-WORKER.
     MOVE "OBJECT1" TO WORKER-ID-STRING.
     MOVE 7 TO WORKER-ID-LENGTH.

* Convert worker-id-string to corba string and
* store as input parameter in createWorker method
     CALL "STRSET"  USING TESTID OF TESTFACTORY-CREATEWORKER-ARGS
                          WORKER-ID-LENGTH
                          WORKER-ID-STRING.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

* Invoke on the createWorker object:
     SET TESTFACTORY-CREATEWORKER TO TRUE.
     CALL "ORBEXEC"  USING FACTORY-OBJ
                           TESTFACTORY-OPERATION
                           TESTFACTORY-CREATEWORKER-ARGS
                           FACTORY-USER-EXCEPTIONS.
     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.

* Store object reference for later calls
     SET WORKER-OBJECT-REF TO
         RESULT OF TESTFACTORY-CREATEWORKER-ARGS.

     EXIT.
```

Invoking on a worker

An implementation of INVOKE-WORKER simply invokes on the retrieved object reference. Because the Worker.runMe() method takes no parameters, the implementation is quite simple:

```
INVOKE-WORKER.
     SET WORKER-RUNME TO TRUE.
     CALL "ORBEXEC"  USING WORKER-OBJECT-REF
                           WORKER-OPERATION
                           WORKER-RUNME-ARGS
                           FACTORY-USER-EXCEPTIONS.
     SET WS-ORBEXEC TO TRUE.
     PERFORM CHECK-STATUS.
     EXIT.
```

Releasing a worker

Finally, before returning to the client mainline where the factory object is destroyed, you should first release the worker object, because it is no longer in use. This is handled in the DESTROY-WORKER method:

```
RELEASE-WORKER.
     CALL "OBJREL"  USING WORKER-OBJECT-REF.
     SET WS-OBJREL TO TRUE.
     PERFORM CHECK-STATUS.
     EXIT.
```

Memory Management of Complex Unbounded Sequences

Overview

This section describes the steps required to correctly construct a sequence containing dynamic content (for example, an unbounded string or a sequence), and also the procedure for freeing this sequence to avoid memory leaks.

Specifically, this worked solution allocates a sequence of unions and assigns the first element as a union of type `long`, the second as a union of type `unbounded string`, and the last as a union of type sequence of unbounded strings. It then shows how this can be used and finally released. At all stages, memory management logic is emphasized.

IDL

This worked solution describes how to successfully allocate, initialize, and free a complex sequence. For the purposes of this walkthrough, the `TestUnion1List` type is used. This describes an unbounded sequence of unions. The union can itself contain a long, a string, or an unbounded sequence of unbounded strings:

```
interface CpxSeq {
    enum TestUnion1Types { TYPE_LONG, TYPE_STRING,
        TYPE_STRINGLIST };
    typedef sequence<string>   StringList;
    union TestUnion1 switch(TestUnion1Types)
    {
        case TYPE_LONG:       long       lVal;
        case TYPE_STRING:     string     sVal;
        case TYPE_STRINGLIST: StringList slVal;
    };
    typedef sequence<TestUnion1>  TestUnion1List;

    void runTest1(inout TestUnion1List p2);
};
```

The COBOL structure that is generated by the Orbix IDL compiler to describe the `CpxSeq.runTest1()` method looks as follows:

```
************************************************************
* Operation:       runTest1
* Mapped name:     runTest1
* Arguments:       <inout> CpxSeq/TestUnion1List p2
* Returns:         none
* User Exceptions: none
************************************************************
 01 CPXSEQ-RUNTEST1-ARGS.
    03 P2-1.
       05 P2.
          07 D                            PICTURE S9(10) BINARY.
             88 TYPE-LONG                 VALUE 0.
             88 TYPE-STRING               VALUE 1.
             88 TYPE-STRINGLIST           VALUE 2.
          07 U.
             09 FILLER                    PICTURE X(20)
                                          VALUE LOW-VALUES.
          07 FILLER REDEFINES U.
             09 LVAL                      PICTURE S9(10) BINARY.
          07 FILLER REDEFINES U.
             09 SVAL                      POINTER.
          07 FILLER REDEFINES U.
             09 SLVAL-1.
                11 SLVAL                  POINTER.
             09 SLVAL-SEQUENCE.
                11 SEQUENCE-MAXIMUM       PICTURE 9(09) BINARY.
                11 SEQUENCE-LENGTH        PICTURE 9(09) BINARY.
                11 SEQUENCE-BUFFER        POINTER.
                11 SEQUENCE-TYPE          POINTER.
    03 P2-SEQUENCE.
       05 SEQUENCE-MAXIMUM                PICTURE 9(09) BINARY
                                          VALUE 0.
       05 SEQUENCE-LENGTH                 PICTURE 9(09) BINARY
                                          VALUE 0.
       05 SEQUENCE-BUFFER                 POINTER
                                          VALUE NULL.
       05 SEQUENCE-TYPE                   POINTER
                                          VALUE NULL.
```

Allocating the outer sequence

`TestUnion1List` is an unbounded sequence. It must therefore be allocated using the `SEQALLOC` API. The following is an example of how to do this, where the sequence `P2` is initalized with a length of 3:

```
SET  CPXSEQ-TESTUNION1LIST TO TRUE.
MOVE 3                TO WS-LENGTH.
CALL "SEQALLOC"  USING WS-LENGTH
                       CPXSEQ-TYPE
                       CPXSEQ-TYPE-LENGTH
                       P2-SEQUENCE OF
                       CPXSEQ-RUNTEST1-ARGS.
SET WS-SEQALLOC TO TRUE.
PERFORM CHECK-STATUS
```

The preceding example requires the Working Storage variable, `WS-LENGTH`, which should be defined as follows:

```
01  WS-LENGTH                     PICTURE 9(09) BINARY.
```

Initializing a sequence element with a union of type long

To initialize a sequence element with a union of type `long` (that is, a non-dynamic basic type), the union discriminator and value should be set in the element buffer, and `SEQSET` should then be called to copy the element from the buffer to the sequence. Because the type does not contain dynamic data, there is no need to free the element buffer after a call to `SEQSET`:

```
* Set union discriminator to type long
         SET TYPE-LONG OF
             D OF P2 OF CPXSEQ-RUNTEST1-ARGS
             TO TRUE

* Set union value to 100
         MOVE 100 TO
             LVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS

* Set element count to 1
         MOVE 1 TO WS-ELEMENT
```

```
* Add union to sequence at position WS-ELEMENT
         CALL "SEQSET" USING
              P2-SEQUENCE OF CPXSEQ-RUNTEST1-ARGS
              WS-ELEMENT-COUNT
              P2-1 OF CPXSEQ-RUNTEST1-ARGS
         SET WS-SEQSET TO TRUE
         PERFORM CHECK-STATUS
```

The preceding example requires the Working Storage variable, `WS-ELEMENT-COUNT`, which should be defined as follows:

```
01  WS-ELEMENT-COUNT                     PICTURE 9(09) BINARY.
```

Initializing a sequence element with a union of type unbounded string

To initialize a sequence element with a union of type unbounded string (that is, a dynamic type), the union discriminator and value should be set in the sequence element buffer. The discriminator value is set to type `string`, and the value is specified via a call to `STRSET`. Once the element is successfully initialized, it is added to the sequence via a call to `SEQSET`.

`SEQSET` performs a deep copy of the element buffer into the sequence. To prevent memory leakage, the application must now free any dynamic data allocated to the element buffer. For the purposes of a union of unbounded string, `STRFREE` must now be called.

The complete code required to add a sequence element of type unbounded string is as follows:

```
* Set union discriminator to type string
        SET TYPE-STRING OF
            D OF P2 OF CPXSEQ-RUNTEST1-ARGS
            TO TRUE

* Set union value to “Hello” (requires STRSET call
* to allocate Corba string)
        MOVE 10 TO WS-STRING-LENGTH
        MOVE “HELLO” TO WS-STRING-VALUE

        CALL "STRSET" USING
             SVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
             WS-STRING-LENGTH
             WS-STRING-VALUE
             SET WS-STRSET TO TRUE
             PERFORM CHECK-STATUS
```

```
* Set element count to 2
       MOVE 2 TO WS-ELEMENT

* Add union to sequence at position WS-ELEMENT
        CALL "SEQSET"  USING P2-SEQUENCE OF CPXSEQ-RUNTEST1-ARGS
                             WS-ELEMENT-COUNT
                             P2-1 OF CPXSEQ-RUNTEST1-ARGS
         SET WS-SEQSET TO TRUE
         PERFORM CHECK-STATUS

* Free element buffer
        CALL "STRFREE"  USING SVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
         SET WS-STRFREE TO TRUE
         PERFORM CHECK-STATUS
```

The preceding example requires the Working Storage variables, `WS-STRING-LENGTH` and `WS-STRING-VALUE`, which should be defined as follows:

```
01  WS-STRING-LENGTH                     PICTURE 9(09) BINARY.
01  WS-STRING VALUE                      PICTURE X(50).
```

Initializing a sequence element with a union of type unbounded string

To initialize a sequence element with a union of type unbounded sequence of unbounded string (that is, a dynamic type), both the union discriminator and value should be specified in the sequence element buffer area.

As an unbounded sequence of unbounded strings, the union value can be initialized by calling `SEQALLOC`, to allocate the inner sequence. The inner sequence (that is, union value) can then be assigned values by calling `STRSET`, `SEQSET` and `STRFREE`. The rules for inner sequences are no different than outer sequences. Because `SEQSET` is called to copy the string allocated via `STRSET` into the sequence, the string must subsequently be freed via a call to `STRFREE`.

Finally, once the union value has been prepared, `SEQSET` is called to copy it into the outer sequence. Then `SEQFREE` must be called on the element buffer to prevent memory leaks:

```
* Set union discriminator to type unbounded sequence
* of unbounded strings
         SET TYPE-STRINGLIST OF
             D OF P2 OF CPXSEQ-RUNTEST1-ARGS
             TO TRUE
```

```
* Set union value to unbounded sequence of strings

* STEP 1: allocate inner sequence
          SET  CPXSEQ-STRINGLIST  TO TRUE
          MOVE 2 TO WS-LENGTH
          CALL "SEQALLOC"  USING WS-LENGTH
                                 CPXSEQ-TYPE
                                 CPXSEQ-TYPE-LENGTH
                                 SLVAL-SEQUENCE OF P2 OF
                                 CPXSEQ-RUNTEST1-ARGS
          SET WS-SEQALLOC TO TRUE
          PERFORM CHECK-STATUS

* STEP 2: Assign some values to the inner sequence

* STEP 2.1: Add string of value “InnerElement 1” as
*           element 1 of union value
           MOVE 20 TO WS-STRING-LENGTH
           MOVE “InnerElement 1” TO WS-STRING-VALUE

           CALL "STRSET"  USING
               SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
               WS-STRING-LENGTH
               WS-STRING-VALUE
           SET WS-STRSET TO TRUE
           PERFORM CHECK-STATUS

           MOVE 1 TO WS-ELEMENT-COUNT
           CALL "SEQSET" USING
               SLVAL-SEQUENCE OF P2 OF
               CPXSEQ-RUNTEST1-ARGS
               WS-ELEMENT-COUNT1
               SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
               SET WS-SEQSET TO TRUE
           PERFORM CHECK-STATUS

* Free element buffer (inner sequence)
           CALL "STRFREE" USING
               SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
               SET WS-STRFREE TO TRUE
               PERFORM CHECK-STATUS
           END-PERFORM
```

```
* STEP 2.2: Add string of value “InnerElement 2” as
*           element 2 of union value
          MOVE 20 TO WS-STRING-LENGTH
          MOVE “InnerElement 2” TO WS-STRING-VALUE

          CALL "STRSET" USING
              SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
              WS-STRING-LENGTH
              WS-STRING-VALUE
          SET WS-STRSET TO TRUE
          PERFORM CHECK-STATUS

          MOVE 2 TO WS-ELEMENT-COUNT
          CALL "SEQSET" USING
              SLVAL-SEQUENCE OF P2 OF
              CPXSEQ-RUNTEST1-ARGS
              WS-ELEMENT-COUNT1
              SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
              SET WS-SEQSET TO TRUE
          PERFORM CHECK-STATUS

* Free element buffer (inner sequence)
          CALL "STRFREE" USING
               SLVAL OF P2 OF CPXSEQ-RUNTEST1-ARGS
          SET WS-STRFREE TO TRUE
          PERFORM CHECK-STATUS
          END-PERFORM

* STEP 3: Add union of sequence of strings to outer
* sequence
          CALL "SEQSET" USING
              P2-SEQUENCE OF CPXSEQ-RUNTEST1-ARGS
              WS-ELEMENT-COUNT
              P2-1 OF CPXSEQ-RUNTEST1-ARGS
          SET WS-SEQSET TO TRUE
          PERFORM CHECK-STATUS

* Free element buffer (outer sequence)
          CALL "SEQFREE" USING
              SLVAL-SEQUENCE
              OF P2 OF CPXSEQ-RUNTEST1-ARGS
          SET WS-SEQFREE TO TRUE
          PERFORM CHECK-STATUS
```

Using initialized sequence

If all the preceding steps are performed, the sequence `p2` should be correctly initialized containing a sequence of unions. This can then be used as normal. For example:

```
* Invoke test function
        SET CPXSEQ-RUNTEST1 TO TRUE.
        CALL "ORBEXEC"  USING COMPLEX-SEQS-OBJ
                              COMPLEXSEQUENCETEST-OPERATION
                              CPXSEQ-RUNTEST1-ARGS
                              CPXSEQ-USER-EXCEPTIONS.
        SET WS-ORBEXEC TO TRUE.
        PERFORM CHECK-STATUS.
```

Final clean-up

The `SEQFREE` API performs a recursive release of sequence data. Therefore, `SEQFREE` only needs to be called on the outer sequence to ensure that memory is cleaned up properly:

```
* Invoke test function
       CALL  "SEQFREE" USING P2-SEQUENCE OF
           CPXSEQ-RUNTEST1-ARGS.
       SET WS-SEQFREE TO TRUE.
       PERFORM CHECK-STATUS.
```

Part 2

Programmer's Reference

In this part

This part contains the following chapters:

API Reference

This chapter summarizes the API functions that are defined for the Orbix COBOL runtime, in pseudo-code. It explains how to use each function, with an example of how to call it from COBOL.

In this chapter

This chapter discusses the following topics:

Note: All parameters are passed by reference to COBOL APIs.

API Reference Summary

Introduction

This section provides a summary of the available API functions, in alphabetic order. See "API Reference Details" on page 411 for more details of each function.

Summary listing

```
ANYFREE(inout POINTER any-pointer)
// Frees memory allocated to an any.

ANYGET(in POINTER any-pointer,
       out buffer any-data-buffer)
// Extracts data out of an any.

ANYSET(inout POINTER any-pointer,
       in buffer any-data-buffer)
// Inserts data into an any.

COAERR(in buffer user-exception-buffer)
// Allows a COBOL server to raise a user exception for an
// operation.

COAGET(in buffer operation-buffer)
// Marshals in and inout arguments for an operation on the server
// side from an incoming request.

COAPUT(out buffer operation-buffer)
// Marshals return, out, and inout arguments for an operation on
// the server side from an incoming request.

COAREQ(in buffer request-details)
// Provides current request information

COARUN
// Indicates the server is ready to accept requests.

MEMALLOC(in 9(09) BINARY memory-size,
         out POINTER memory-pointer)
// Allocates memory at runtime from the program heap.

MEMFREE(inout POINTER memory-pointer)
// Frees dynamically allocated memory.
```

```
OBJDUP(in POINTER object-reference,
       out POINTER duplicate-obj-ref)
// Duplicates an object reference.

OBJGETID(in POINTER object-reference,
         out X(nn) object-id,
         in 9(09) BINARY object-id-length)
// Retrieves the object ID from an object reference.

OBJNEW(in X(nn) server-name,
       in X(nn) interface-name,
       in X(nn) object-id,
       out POINTER object-reference)
// Creates a unique object reference.

OBJREL(inout POINTER object-reference)
// Releases an object reference.

OBJRIR(in X(nn) desired-service,
       out POINTER object-reference)
// Returns an object reference to an object through which a
// service such as the Naming Service can be used.

OBJTOSTR(in POINTER object-reference,
         out POINTER object-string)
// Returns a stringified interoperable object reference (IOR)
// from a valid object reference.

ORBARGS(in X(nn) argument-string,
        in 9(09) BINARY argument-string-length,
        in X(nn) orb-name,
        in 9(09) BINARY orb-name-length)
// Initializes a client or server connection to an ORB.

ORBEXEC(in POINTER object-reference,
        in X(nn) operation-name,
        inout buffer operation-buffer,
        inout buffer user-exception-buffer)
// Invokes an operation on the specified object.

ORBHOST(in 9(09) BINARY hostname-length,
        out X(nn) hostname)
// Returns the hostname of the server

ORBREG(in buffer interface-description)
// Describes an IDL interface to the COBOL runtime.
```

```
ORBSRVR(in X(nn) server-name,
        in 9(09) BINARY server-name-length)
// Sets the server name for the current server process.

ORBSTAT(in buffer status-buffer)
// Registers the status information block.

ORBTIME(in 9(04) BINARY timeout-type
        in 9(09) BINARY timeout-value)
// Used by clients for setting the call timeout.
// Used by servers for setting the event timeout.

ORBTXNB
// Indicate the beginning of a two-phase commit transaction.

ORBTXNE
// Indicate the end of a two-phase commit transaction.

SEQALLOC(in 9(09) BINARY sequence-size,
         in X(nn) typecode-key,
         in 9(09) BINARY typecode-key-length,
         inout buffer sequence-control-data)
// Allocates memory for an unbounded sequence

SEQDUP(in buffer sequence-control-data,
       out buffer dupl-seq-control-data)
// Duplicates an unbounded sequence control block.

SEQFREE(inout buffer sequence-control-data)
// Frees the memory allocated to an unbounded sequence.

SEQGET(in buffer sequence-control-data,
       in 9(09) BINARY element-number,
       out buffer sequence-data)
// Retrieves the specified element from an unbounded sequence.

SEQSET(out buffer sequence-control-data,
       in 9(09) BINARY element-number,
       in buffer sequence-data)
// Places the specified data into the specified element of an
// unbounded sequence.

STRFREE(in POINTER string-pointer)
// Frees the memory allocated to a bounded string.
```

```
STRGET(in POINTER string-pointer,
       in 9(09) BINARY string-length,
       out X(nn) string)
// Copies the contents of an unbounded string to a bounded string.

STRLEN(in POINTER string-pointer,
       out 9(09) BINARY string-length)
// Returns the actual length of an unbounded string.
STRSET(out POINTER string-pointer,
       in 9(09) BINARY string-length,
       in X(nn) string)
// Creates a dynamic string from a PIC X(n) data item

STRSETP(out POINTER string-pointer,
        in 9(09) BINARY string-length,
        in X(nn) string)
// Creates a dynamic string from a PIC X(n) data item.

STRTOOBJ(in POINTER object-string,
       out POINTER object-reference)
// Creates an object reference from an interoperable object
// reference (IOR).

TYPEGET(inout POINTER any-pointer,
        in 9(09) BINARY typecode-key-length,
        out X(nn) typecode-key)
// Extracts the type name from an any.

TYPESET(inout POINTER any-pointer,
        in 9(09) BINARY typecode-key-length,
        in X(nn) typecode-key)
// Sets the type name of an any.

WSTRFREE(in POINTER string-pointer)
// Frees the memory allocated to a bounded wide string.

WSTRGET(in POINTER string-pointer,
        in 9(09) BINARY string-length,
        out G(nn) string)
// Copies the contents of an unbounded wide string to a bounded
// wide string.

WSTRLEN(in POINTER string-pointer,
        out 9(09) BINARY string-length)
// Returns the actual length of an unbounded wide string.
```

```
WSTRSET(out POINTER string-pointer,
        in 9(09) BINARY string-length
        in G(nn) string)
// Creates a dynamic wide string from a PIC G(n) data item

WSTRSETP(out POINTER string-pointer,
         in 9(09) BINARY string-length,
         in G(nn) string)
// Creates a dynamic wide string from a PIC G(n) data item.
```

API Reference Details

Introduction

This section provides details of each available API function, in alphabetic order.

In this section

This section discusses the following topics:

ANYFREE

Synopsis

```
ANYFREE(inout POINTER any-pointer);
// Frees memory allocated to an any.
```

Usage

Common to clients and servers.

Description

The `ANYFREE` function releases the memory held by an `any` type that is being used to hold a value and its corresponding typecode. Do not try to use the `any` type after freeing its memory, because doing so might result in a runtime error.

When you call the `ANYSET` function, it allocates memory to store the actual value of the `any`. When you call the `TYPESET` function, it allocates memory to store the typecode associated with the value to be marshalled. When you subsequently call `ANYFREE`, it releases the memory that has been allocated via `ANYSET` and `TYPESET`.

Parameters

The parameter for `ANYFREE` can be described as follows:

`any-pointer`	This is an `inout` parameter that is a pointer to the address in memory where the `any` is stored.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
//IDL
interface sample {
        attribute any myany;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
01 SAMPLE-MYANY-ARGS.
   03 RESULT                                 POINTER
                                             VALUE NULL.
```

3. The following is an example of how to use ANYFREE in your client or server program:

```
…
PROCEDURE DIVISION.
    CALL "ANYFREE" USING RESULT OF SAMPLE-MYANY-ARGS.
…
```

See also

- "ANYSET" on page 418.
- "TYPESET" on page 522.
- "The any Type and Memory Management" on page 380.

ANYGET

Synopsis

```
ANYGET(in POINTER any-pointer,
       out buffer any-data-buffer)
// Extracts data out of an any.
```

Usage

Common to clients and servers.

Description

The `ANYGET` function provides access to the buffer value that is contained in an `any`. You should check to see what type of data is contained in the `any`, and then ensure you supply a data buffer that is large enough to receive its contents. Before you call `ANYGET` you can use `TYPEGET` to extract the type of the data contained in the `any`.

Parameters

The parameters for `ANYGET` can be described as follows:

`any-pointer`	This is an `inout` parameter that is a pointer to the address in memory where the `any` is stored.
`any-data-buffer`	This is an `out` parameter that can be of any valid COBOL type. It is used to store the value extracted from the `any`.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface sample {
     attribute any myany;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the `idlmembername` copybook (where `idlmembername` represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
01 SAMPLE-MYANY-ARGS.
   03 RESULT                           POINTER
                                       VALUE NULL.
…
01 EXAMPLE-TYPE                        PICTURE X(15).
    COPY CORBATYP.
   88 SAMPLE                         VALUE "IDL:sample:1.0".
01 EXAMPLE-TYPE-LENGTH                 PICTURE S9(09) BINARY
                                       VALUE 22.
```

3. The following is an example of how to use `ANYSET` in a client or server program:

```
WORKING-STORAGE SECTION.
   01 WS-DATA                           PIC S9(10) VALUE 0.

CALL "TYPEGET" USING RESULT OF SAMPLE-MYANY-ARGS
                     EXAMPLE-TYPE-LENGTH
                     EXAMPLE-TYPE.
SET WS-TYPEGET TO TRUE.
PERFORM CHECK-STATUS.
* validate typecode
  EVALUATE TRUE
      WHEN CORBA-TYPE-LONG
* retrieve the ANY CORBA::Short value
          CALL "ANYGET" USING RESULT OF SAMPLE-MYANY-ARGS
                              WS-DATA
          SET WS-ANYGET TO TRUE
          PERFORM CHECK-STATUS
          DISPLAY "ANY value equals " WS-DATA.
      WHEN OTHER
          DISPLAY "Wrong typecode received, expected a LONG
              typecode"
  END-EVALUTE.
```

See also

"ANYSET" on page 418.

ANYSET

Synopsis

```
ANYSET(inout POINTER any-pointer,
       in buffer any-data-buffer)
// Inserts data into an any.
```

Usage

Common to clients and servers.

Description

The `ANYSET` function copies the supplied data, which is placed in the data buffer by the application, into the `any`. `ANYSET` allocates memory that is required to store the value of the `any`. You must call `TYPESET` before calling `ANYSET`, to set the typecode of the `any`. Ensure that this typecode matches the type of the data being copied to the `any`.

Parameters

The parameters for `ANYSET` can be described as follows:

`any-pointer`	This is an `inout` parameter that is a pointer to the address in memory where the `any` is stored.
`any-data-buffer`	This is an `in` parameter that can be of any valid COBOL type. It contains the value to be copied to the `any`.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface sample {
    attribute any myany;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
01 SAMPLE-MYANY-ARGS.
   03 RESULT                            POINTER
                                        VALUE NULL.
…
01 EXAMPLE-TYPE                         PICTURE X(15).
    COPY CORBATYP.
   88 SAMPLE                          VALUE "IDL:sample:1.0".
01 EXAMPLE-TYPE-LENGTH                  PICTURE S9(09) BINARY
                                        VALUE 22.
```

3. The following is an example of how to use `ANYSET` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-DATA                              PIC S9(10) VALUE 100.

PROCEDURE DIVISION.
…
* Set the ANY typecode to be a CORBA::Long
  SET CORBA-TYPE-LONG TO TRUE.
  CALL "TYPESET" USING RESULT OF
                       SAMPLE-MYANY-ARGS
                       EXAMPLE-TYPE-LENGTH
                       EXAMPLE-TYPE.
  SET WS-TYPESET TO TRUE.
  PERFORM CHECK-STATUS.
* Set the ANY value to 100
  CALL "ANYSET" USING RESULT OF SAMPLE-MYANY-ARGS
                      WS-DATA.
  SET WS-TYPESET TO TRUE.
  PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::BAD_INV_ORDER::TYPESET_NOT_CALLED` exception is raised if the typecode of the `any` has not been set via the `TYPESET` function.

See also

- "ANYGET" on page 416.
- "TYPESET" on page 522.

- "The any Type and Memory Management" on page 380.

COAERR

Synopsis

```
COAERR(in buffer user-exception-buffer)
// Allows a COBOL server to raise a user exception for an
// operation.
```

Usage

Server-specific.

Description

The COAERR function allows a COBOL server to raise a user exception for the operation that supports the exception(s), which can then be picked up on the client side via the user exception buffer that is passed to ORBEXEC for the relevant operation. To raise a user exception, the server program must set the EXCEPTION-ID, the D discriminator, and the appropriate exception buffer.

The server calls COAERR instead of COAPUT in this instance, and this informs the client that a user exception has been raised. Refer to the "Memory Handling" on page 365 for more details. Calling COAERR does not terminate the server program.

The client can determine if a user exception has been raised, by testing to see whether the EXCEPTION-ID of the operation's user-exception-buffer parameter passed to ORBEXEC is equal to zero after the call. Refer to "ORBEXEC" on page 462 for an example of how a COBOL client determines if a user exception has been raised.

Parameters

The parameter for COAERR can be described as follows:

user-exception-buffer	This is an in parameter that contains the COBOL representation of the user exceptions that the operation supports, as defined in the *idlmembername* copybook generated by the Orbix IDL compiler. If the IDL operation supports no user exceptions, a dummy buffer is generated—this dummy buffer is not populated on the server side, and it is only used as the fourth (in this case, dummy) parameter to ORBEXEC.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
//IDL
interface sample {
    typedef string<10> Aboundedstring;
    exception MyException  { Aboundedstring except_str; };
    Aboundedstring myoperation(in Aboundedstring instr,
        inout Aboundedstring inoutstr,
        out Aboundedstring outstr)
        raises (myException);
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 25: *The idlmembername Copybook (Sheet 1 of 2)*

```
**************************************************************
* Operation:       myoperation
* Mapped name:     myoperation
* Arguments:       <in> sample/Aboundedstring instr
*                  <inout> sample/Aboundedstring inoutstr
*                  <out> sample/Aboundedstring outstr
* Returns:         sample/Aboundedstring
* User Exceptions: sample/MyException
**************************************************************
* operation-buffer
01 SAMPLE-MYOPERATION-ARGS.
   03 INSTR                                PICTURE X(10).
   03 INOUTSTR                             PICTURE X(10).
   03 OUTSTR                               PICTURE X(10).
   03 RESULT                               PICTURE X(10).
*************************************************************
COPY EXAMPLX.
*************************************************************

*************************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
```

Example 25: *The idlmembername Copybook (Sheet 2 of 2)*

```
*
*********************************************************
* The operation-name and its corresponding 88 level entry
01 SAMPLE-OPERATION                       PICTURE X(27).
   88 SAMPLE-MYOPERATION                  VALUE
      "myoperation:IDL:sample:1.0".
01 SAMPLE-OPERATION-LENGTH                PICTURE 9(09)
                                          BINARY  VALUE 27.

******************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
*******************************************************

01 EXAMPLE-TYPE                           PICTURE X(29).
     COPY CORBATYP.
   88 SAMPLE-ABOUNDEDSTRING               VALUE
       "IDL:sample/Aboundedstring:1.0".
01 EXAMPLE-TYPE-LENGTH                    PICTURE S9(09)
                                          BINARY VALUE 29.
***********************************************************
* User exception block
**********************************************************
01 EX-SAMPLE-MYEXCEPTION                  PICTURE X(26)
                                          VALUE
   "IDL:sample/MyException:1.0".
01 EX-SAMPLE-MYEXCEPTION-LENGTH           PICTURE 9(09)
                                          BINARY VALUE 26.
* user-exception-buffer

01 EXAMPLE-USER-EXCEPTIONS.
   03 EXCEPTION-ID                        POINTER
                                          VALUE NULL.
   03 D                                   PICTURE 9(10) BINARY
                                          VALUE 0.
     88 D-NO-USEREXCEPTION                VALUE 0.
     88 D-SAMPLE-MYEXCEPTION              VALUE 1.
     03 U                                 PICTURE X(10)
                                          VALUE LOW-VALUES.
     03 EXCEPTION-SAMPLE-MYEXCEPTION      REDEFINES U.
     05 EXCEPT-STR                        PICTURE X(10).
```

3. The following is an example of the server implementation code for the `myoperation` operation:

```
DO-SAMPLE-MYOPERATION.
    SET D-NO-USEREXCEPTION TO TRUE.
    CALL "COAGET" USING SAMPLE-MYOPERATION-ARGS.
    SET WS-COAGET TO TRUE.
    PERFORM CHECK-STATUS.

* Assuming some error has occurred in the application
           IF APPLICATION-ERROR
* Raise the appropriate user exception
               SET D-SAMPLE-MYEXCEPTION TO TRUE

* Populate the values of the exception to be bassed back to
* the client
       CALL "STRSET"  USING EXCEPTION-ID
                            OF EXAMPLE-USER-EXCEPTIONS
                            EX-SAMPLE-MYEXCEPTION-LENGTH
                            EX-SAMPLE-MYEXCEPTION.
       SET WS-STRSET TO TRUE.
       PERFORM CHECK-STATUS.

       MOVE "FATAL ERROR " TO EXCEPT-STR
             OF EXAMPLE-USER-EXCEPTIONS
       CALL "COAERR" USING EXAMPLE-USER-EXCEPTIONS
       SET WS-COAERR TO TRUE
       PERFORM CHECK-STATUS
   ELSE
*all okay pass back the out/inout/return parameters.
       CALL "COAPUT" USING SAMPLE-MYOPERATION-ARGS
       SET WS-COAPUT TO TRUE
       PERFORM CHECK-STATUS
   END-IF.
```

Exceptions

The appropriate CORBA exception is raised if an attempt is made to raise a user exception that is not related to the invoked operation.

A `CORBA::BAD_PARAM::UNKNOWN_TYPECODE` exception is raised if the typecode cannot be determined when marshalling an `any` type or a user exception.

See also

- "COAGET" on page 426.
- "COAPUT" on page 431.
- "ORBEXEC" on page 462.
- The BANK demonstration in *orbixhlq*.DEMO.CBL.SRC for a complete example of how to use COAERR.

COAGET

Synopsis

```
COAGET(in buffer operation-buffer)
// Marshals in and inout arguments for an operation on the server
// side from an incoming request.
```

Usage

Server-specific.

Description

Each operation implementation must begin with a call to `COAGET` and end with a call to `COAPUT`. Even if the operation takes no parameters and has no return value, you must still call `COAGET` and `COAPUT` and, in such cases, pass a dummy `PIC X(1)` data item, which the Orbix IDL compiler generates for such cases.

`COAGET` copies the incoming operation's argument values into the complete COBOL operation parameter buffer that is supplied. This buffer is generated automatically by the Orbix IDL compiler. Only `in` and `inout` values in this structure are populated by this call.

The Orbix IDL compiler generates the call for `COAGET` in the *`idlmembername`*`S` source module (where *`idlmembername`* represents the name of the IDL member that contains the IDL definitions) for each attribute and operation defined in the IDL.

Parameters

The parameter for `COAGET` can be described as follows:

`operation-buffer`	This is an `in` parameter that contains a COBOL `01` level data item representing the data types that the operation supports.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface sample {
    typedef string<10> Aboundedstring;
    exception MyException  { Aboundedstring except_str; };
    Aboundedstring myoperation(in Aboundedstring instr,
        inout Aboundedstring inoutstr,
        out Aboundedstring outstr)
        raises (MyException);
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 26: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:       myoperation
* Mapped name:     myoperation
* Arguments:       <in> sample/Aboundedstring instr
*                  <inout> sample/Aboundedstring inoutstr
*                  <out> sample/Aboundedstring outstr
* Returns:         sample/Aboundedstring
* User Exceptions: sample/MyException
**********************************************************
* operation-buffer
01 SAMPLE-MYOPERATION-ARGS.
   03 INSTR                                  PICTURE X(10).
   03 INOUTSTR                               PICTURE X(10).
   03 OUTSTR                                 PICTURE X(10).
   03 RESULT                                 PICTURE X(10).
**********************************************************
COPY EXAMPLX.
**********************************************************
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************
```

Example 26: *The idlmembername Copybook (Sheet 2 of 2)*

```
* The operation-name and its corresponding 88 level entry
01 SAMPLE-OPERATION                          PICTURE X(27).
   88 SAMPLE-MYOPERATION                     VALUE
          "myoperation:IDL:sample:1.0".
01 SAMPLE-OPERATION-LENGTH                   PICTURE 9(09)
                                             BINARY VALUE 27.

***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************

01 EXAMPLE-TYPE                              PICTURE X(29).
     COPY CORBATYP.
   88 SAMPLE-ABOUNDEDSTRING                  VALUE
          "IDL:sample/Aboundedstring:1.0".
01 EXAMPLE-TYPE-LENGTH                       PICTURE S9(09)
       BINARY  VALUE 29.
      **********************************************************
* User exception block
**********************************************************
01 EX-SAMPLE-MYEXCEPTION                     PICTURE X(26)
                                             VALUE
          "IDL:sample/MyException:1.0".
01 EX-SAMPLE-MYEXCEPTION-LENGTH              PICTURE 9(09)
                                             BINARY VALUE 26.
* user-exception-buffer

01 EXAMPLE-USER-EXCEPTIONS.
    03 EXCEPTION-ID                           POINTER
                                              VALUE NULL.
    03 D                                      PICTURE 9(10)
                                              BINARY VALUE 0.
    88 D-NO-USEREXCEPTION                     VALUE 0.
    88 D-SAMPLE-MYEXCEPTION                   VALUE 1.
   03 U                                       PICTURE X(10)
                                              VALUE LOW-VALUES.
   03 EXCEPTION-SAMPLE-MYEXCEPTION            REDEFINES U.
     05 EXCEPT-STR                            PICTURE X(10).
```

3. The following is an example of the server implementation code for the `myoperation` operation, which is generated in the *`idlmembername`*`S` source member when you specify the `-Z` argument with the Orbix IDL compiler:

```
       DO-SAMPLE-MYOPERATION.
           SET D-NO-USEREXCEPTION TO TRUE.
           CALL "COAGET" USING SAMPLE-MYOPERATION-ARGS.
           SET WS-COAGET TO TRUE.
           PERFORM CHECK-STATUS.

    * TODO:  Add your operation specific code here

           EVALUATE TRUE
           WHEN D-NO-USEREXCEPTION
           CALL "COAPUT" USING SAMPLE-MYOPERATION-ARGS
           SET WS-COAPUT TO TRUE
           PERFORM CHECK-STATUS
           END-EVALUATE.
```

4. The following is an example of a modified version of the code in point 3 for the `myoperation` operation:

```
When changed for this operation can look like this
Sample server implementation for myoperation

       DO-SAMPLE-MYOPERATION.
          SET D-NO-USEREXCEPTION TO TRUE.
          CALL "COAGET" USING SAMPLE-MYOPERATION-ARGS.
          SET WS-COAGET TO TRUE.
* Display what the client passed in
          DISPLAY "In parameter value equals "
          INSTR OF SAMPLE-MYOPERATION-ARGS.
          DISPLAY "Inout  parameter value equals "
          INOUTSTR OF SAMPLE-MYOPERATION-ARGS.

*Now must populate the inout/out/return parameters if
*applicable. See COAPUT for example.
           EVALUATE TRUE
           WHEN D-NO-USEREXCEPTION
           CALL "COAPUT" USING SAMPLE-MYOPERATION-ARGS
           SET WS-COAPUT TO TRUE
           PERFORM CHECK-STATUS
           END-EVALUATE.
```

Exceptions

A `CORBA::BAD_INV_ORDER::ARGS_ALREADY_READ` exception is raised if the `in` or `inout` parameter for the request has already been processed.

A `CORBA::BAD_PARAM::INVALID_DISCRIMINATOR_TYPECODE` exception is raised if the discriminator typecode is invalid when marshalling a union type.

A `CORBA::BAD_PARAM::UNKNOWN_TYPECODE` exception is raised if the typecode cannot be determined when marshalling an `any` type or a user exception.

A `CORBA::DATA_CONVERSION::VALUE_OUT_OF_RANGE` exception is raised if the value is determined to be out of range when marshalling a `long`, `short`, `unsigned short`, `unsigned long long`, or `unsigned long long` type.

See also

- "COAERR" on page 421.
- "ORBEXEC" on page 462.

COAPUT

Synopsis

```
COAPUT(out buffer operation-buffer)
// Marshals return, out, and inout arguments for an operation on
// the server side from an incoming request.
```

Usage

Server-specific.

Description

Each operation implementation must begin with a call to `COAGET` and end with a call to `COAPUT`. The `COAPUT` function copies the operation's outgoing argument values from the complete COBOL operation parameter buffer passed to it. This buffer is generated automatically by the Orbix IDL compiler. Only `inout`, `out`, and the `result out` item are populated by this call.

You must ensure that all `inout`, `out`, and `result` values are correctly allocated (for dynamic types) and populated. If a user exception has been raised before calling `COAPUT`, no `inout`, `out`, or `result` parameters are marshalled, and nothing is returned in such cases. If a user exception has been raised, COAERR must be called instead of COAPUT, and no inout, out, or result parameters are marshalled. Refer to "COAERR" on page 421 for more details.

The Orbix IDL compiler generates the call for `COAPUT` in the `idlmembernameS` source module for each attribute and operation defined in the IDL.

Parameters

The parameter for `COAPUT` can be described as follows:

`operation-buffer`	This is an `out` parameter that contains a COBOL `01` level data item representing the data types that the operation supports.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface sample {
    typedef string<10> Aboundedstring;
    exception MyException  { Aboundedstring except_str; };
    Aboundedstring myoperation(in Aboundedstring instr,
        inout Aboundedstring inoutstr,
        out Aboundedstring outstr)
        raises (MyException);
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 27: *The idlmembername Copybook (Sheet 1 of 2)*

```
**********************************************************
* Operation:       myoperation
* Mapped name:     myoperation
* Arguments:       <in> sample/Aboundedstring instr
*                  <inout> sample/Aboundedstring inoutstr
*                  <out> sample/Aboundedstring outstr
* Returns:         sample/Aboundedstring
* User Exceptions: sample/MyException
***********************************************************
* operation-buffer
01 SAMPLE-MYOPERATION-ARGS.
   03 INSTR                               PICTURE X(10).
   03 INOUTSTR                            PICTURE X(10).
   03 OUTSTR                              PICTURE X(10).
   03 RESULT                              PICTURE X(10).
**********************************************************
COPY EXAMPLX.
**********************************************************
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface  supports
*
***********************************************************
```

Example 27: *The idlmembername Copybook (Sheet 2 of 2)*

```
* The operation-name and its corresponding 88 level entry
01 SAMPLE-OPERATION                       PICTURE X(27).
   88 SAMPLE-MYOPERATION                  VALUE
        "myoperation:IDL:sample:1.0".
01 SAMPLE-OPERATION-LENGTH                PICTURE 9(09)
                                          BINARY VALUE 27.

**********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************

01 EXAMPLE-TYPE                           PICTURE X(29).
     COPY CORBATYP.
   88 SAMPLE-ABOUNDEDSTRING                 VALUE
      "IDL:sample/Aboundedstring:1.0".
01 EXAMPLE-TYPE-LENGTH                    PICTURE S9(09)
                                          BINARY VALUE 29.

   ***********************************************************
* User exception block
***********************************************************

01 EX-SAMPLE-MYEXCEPTION                  PICTURE X(26)
                                          VALUE
      "IDL:sample/MyException:1.0".
01 EX-SAMPLE-MYEXCEPTION-LENGTH           PICTURE 9(09)
                                          BINARY VALUE 26.
* user exception buffer
01 EXAMPLE-USER-EXCEPTIONS.
   03 EXCEPTION-ID                         POINTER
                                           VALUE NULL.
   03 D                                    PICTURE 9(10)
                                           BINARY.
                                           VALUE 0.
      88 D-NO-USEREXCEPTION                VALUE 0.
      88 D-SAMPLE-MYEXCEPTION              VALUE 1.
   03 U                                    PICTURE X(10)
                                           VALUE LOW-VALUES.
   03 EXCEPTION-SAMPLE-MYEXCEPTION         REDEFINES U.
      05 EXCEPT-STR                        PICTURE X(10).
```

3. The following is an example of the server implementation code for the `myoperation` operation, which is generated in the *`idlmembername`*`S` source member when you specify the `-Z` argument with the Orbix IDL compiler:

```
       DO-SAMPLE-MYOPERATION.
           SET D-NO-USEREXCEPTION TO TRUE.
           CALL "COAGET" USING SAMPLE-MYOPERATION-ARGS.
           SET WS-COAGET TO TRUE.
           PERFORM CHECK-STATUS.

      * TODO:  Add your operation specific code here

           EVALUATE TRUE
           WHEN D-NO-USEREXCEPTION
           CALL "COAPUT" USING SAMPLE-MYOPERATION-ARGS
           SET WS-COAPUT TO TRUE
           PERFORM CHECK-STATUS
           END-EVALUATE.
```

4. The following is an example of a modified version of the code in point 3 for the `myoperation` operation

```
When changed for this operation can look like this
Sample server implementation for myoperation

 DO-SAMPLE-MYOPERATION.
      SET D-NO-USEREXCEPTION TO TRUE.
      CALL "COAGET" USING SAMPLE-MYOPERATION-ARGS.
      SET WS-COAGET TO TRUE.
* Display what the client passed in
      DISPLAY "In parameter value equals "
      INSTR OF SAMPLE-MYOPERATION-ARGS.
      DISPLAY "Inout  parameter value equals "
      INOUTSTR OF SAMPLE-MYOPERATION-ARGS.

*Now must populate the inout/out/return parameters if
*applicable
       MOVE "Client" TO INOUTSTR OF SAMPLE-MYOPERATION-ARGS.
       MOVE "xxxxx"  TO OUTSTR OF SAMPLE-MYOPERATION-ARGS.
       MOVE "YYYYY"  TO RESULT OF SAMPLE-MYOPERATION-ARGS.

       EVALUATE TRUE
       WHEN D-NO-USEREXCEPTION
       CALL "COAPUT" USING SAMPLE-MYOPERATION-ARGS
       SET WS-COAPUT TO TRUE
       PERFORM CHECK-STATUS
       END-EVALUATE.
```

Exceptions

A `CORBA::BAD_INV_ORDER::ARGS_NOT_READ` exception is raised if the `in` or `inout` parameters for the request have not been processed.

A `CORBA::BAD_PARAM::INVALID_DISCRIMINATOR_TYPECODE` exception is raised if the discriminator typecode is invalid when marshalling a union type.

A `CORBA::BAD_PARAM::UNKNOWN_TYPECODE` exception is raised if the typecode cannot be determined when marshalling an `any` type or a user exception.

A `CORBA::DATA_CONVERSION::VALUE_OUT_OF_RANGE` exception is raised if the value is determined to be out of range when marshalling a `long`, `short`, `unsigned short`, `unsigned long long long`, or `unsigned long long` type.

See also

- "COAERR" on page 421.

- "ORBEXEC" on page 462.

COAREQ

Synopsis

```
COAREQ(in buffer request-details)
// Provides current request information
```

Usage

Server-specific.

Description

The server implementation program calls `COAREQ` to extract the relevant information about the current request. `COAREQ` provides information about the current invocation request in a request information buffer, which is defined as follows in the supplied `CORBA` copybook:

```
01 REQUEST-INFO.
   03  INTERFACE-NAME     USAGE IS POINTER VALUE NULL.
   03  OPERATION-NAME     USAGE IS POINTER VALUE NULL.
   03  PRINCIPAL          USAGE IS POINTER VALUE NULL.
   03  TARGET             USAGE IS POINTER VALUE NULL.
```

In the preceding structure, the first three data items are unbounded CORBA character strings. You can use the `STRGET` function to copy the values of these strings to COBOL bounded string data items. The `TARGET` item in the preceding structure is the COBOL object reference for the operation invocation. After `COAREQ` is called, the structure contains the following data:

`INTERFACE-NAME`	The name of the interface, which is stored as an unbounded string.
`OPERATION-NAME`	The name of the operation for the invocation request, which is stored as an unbounded string.
`PRINCIPAL`	The name of the client principal that invoked the request, which is stored as an unbounded string.
`TARGET`	The object reference of the target object.

You can call `COAREQ` only once for each operation invocation. It must be called after a request has been dispatched to a server, and before any calls are made to access the parameter values. Supplied code is generated in the *`idlmembername`*`S` source module by the Orbix IDL compiler when you specify the `-Z` argument. Ensure that the COBOL bounded string and the length fields are large enough to retrieve the data from the `REQUEST-INFO` pointers.

Parameters

The parameter for `COAREQ` can be described as follows:

`request-details`	This is an `in` parameter that contains a COBOL `01` level data item representing the current request.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
//IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 28: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:       call_me
* Mapped name:     call_me
* Arguments:       None
* Returns:         void
* User Exceptions: none
***********************************************************
01 SIMPLE-SIMPLEOBJECT-70FE-ARGS.
   03 FILLER                               PICTURE X(01).
***********************************************************
 COPY SIMPLEX.
***********************************************************
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
```

Example 28: *The idlmembername Copybook (Sheet 2 of 2)*

```
************************************************************

01 SIMPLE-SIMPLEOBJECT-OPERATION          PICTURE X(36).
   88 SIMPLE-SIMPLEOBJECT-CALL-ME         VALUE
      "call_me:IDL:Simple/SimpleObject:1.0".
01 SIMPLE-S-3497-OPERATION-LENGTH         PICTURE 9(09)
                                          BINARY VALUE 36.

************************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
************************************************************
01 SIMPLE-TYPE                            PICTURE X(27).
      COPY CORBATYP.
   88 SIMPLE-SIMPLEOBJECT                 VALUE
       "IDL:Simple/SimpleObject:1.0".
01 SIMPLE-TYPE-LENGTH                     PICTURE S9(09)
                                          BINARY VALUE 27.
```

3. The following is an example of the server implementation code generated in the `idlmembernameS` server implementation member:

Example 29: *Part of the idlmembernameS Program (Sheet 1 of 2)*

```
 WORKING-STORAGE SECTION
  01 WS-INTERFACE-NAME                      PICTURE X(30).
  01 WS-INTERFACE-NAME-LENGTH               PICTURE 9(09) BINARY
                                                 VALUE 30.
       PROCEDURE DIVISION.

           ENTRY "DISPATCH".

           CALL "COAREQ"    USING REQUEST-INFO.
           SET WS-COAREQ TO TRUE.
           PERFORM CHECK-STATUS.

      * Resolve the pointer reference to the interface name
      * which is the fully scoped interface name.
      * Note make sure it can handle the max interface name
      * length.
           CALL "STRGET"    USING INTERFACE-NAME
                                  WS-INTERFACE-NAME-LENGTH
```

Example 29: *Part of the idlmembernameS Program (Sheet 2 of 2)*

```
                                   WS-INTERFACE-NAME.
           SET WS-STRGET TO TRUE.
           PERFORM CHECK-STATUS.

***********************************************************
* Interface(s)  evaluation:
***********************************************************
           MOVE SPACES TO SIMPLE-SIMPLEOBJECT-OPERATION.

           EVALUATE WS-INTERFACE-NAME
           WHEN 'IDL:Simple/SimpleObject:1.0'
      * Resolve the pointer reference to the operation
       * information
            CALL "STRGET" USING OPERATION-NAME
                                SIMPLE-S-3497-OPERATION-LENGTH
                                SIMPLE-SIMPLEOBJECT-OPERATION
            SET WS-STRGET TO TRUE
            PERFORM CHECK-STATUS
            DISPLAY  "Simple::" SIMPLE-SIMPLEOBJECT-OPERATION
              "invoked"
           END-EVALUATE.
       COPY SIMPLED.

           GOBACK.
       DO-SIMPLE-SIMPLEOBJECT-CALL-ME.
        CALL "COAGET"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
        SET WS-COAGET TO TRUE.
        PERFORM CHECK-STATUS.

        CALL "COAPUT"    USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
        SET WS-COAPUT TO TRUE.
         PERFORM CHECK-STATUS.

********************************************************
* Check Errors Copybook
********************************************************
       COPY CHKERRS.
```

Note: The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

Exceptions

A CORBA::BAD_INV_ORDER::NO_CURRENT_REQUEST exception is raised if there is no request currently in progress.

A CORBA::BAD_INV_ORDER::SERVER_NAME_NOT_SET exception is raised if ORBSRVR is not called.

COARUN

Synopsis

```
COARUN
// Indicates the server is ready to accept requests.
```

Usage

Server-specific.

Description

The `COARUN` function indicates that a server is ready to start receiving client requests. It is equivalent to calling `ORB::run()` in C++. Refer to the *CORBA Programmer's Reference, C++* for more details about `ORB::run()`. There are no parameters required for calling `COARUN`.

Parameters

`COARUN` takes no parameters.

Example

The following is an example of how to use `COARUN` in your server mainline program:

```
DISPLAY "Giving control to the ORB to process requests".

    CALL "COARUN".
    SET WS-COARUN TO TRUE.
    PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::BAD_INV_ORDER::SERVER_NAME_NOT_SET` exception is raised if `ORBSRVR` is not called.

MEMALLOC

Synopsis

```
MEMALLOC(in 9(09) BINARY memory-size,
         out POINTER memory-pointer)
// Allocates memory at runtime from the program heap.
```

Usage

Common to clients and servers.

Description

The `MEMALLOC` function allocates the specified number of bytes from the program heap at runtime, and returns a pointer to the start of this memory block.

`MEMALLOC` is used to allocate space for dynamic structures. However, it is recommended that you use `SEQALLOC` when allocating memory for sequences, because `SEQALLOC` can automatically determine the amount of memory required for sequences. Refer to "SEQALLOC" on page 482 for more details.

Parameters

The parameters for `MEMALLOC` can be described as follows:

`memory-size`	This is an `in` parameter that specifies in bytes the amount of memory that is to be allocated.
`memory-pointer`	This is an `out` parameter that contains a pointer to the allocated memory block.

Exceptions

A `CORBA::NO_MEMORY` exception is raised if there is not enough memory available to complete the request. In this case, the pointer will contain a null value.

Example

The following is an example of how to use MEMALLOC in a client or server program:

```
WORKING-STORAGE SECTION.

01 WS-MEMORY-BLOCK                    POINTER VALUE NULL.
01 WS-MEMORY-BLOCK-SIZE             PICTURE 9(09) BINARY VALUE 30.

PROCEDURE DIVISION.
…
* allocates 30 bytes of memory at runtime from the heap
    CALL "MEMALLOC" USING WS-MEMORY-BLOCK-SIZE
                          WS-MEMORY-BLOCK.
```

See also

- “MEMFREE” on page 445.
- “Memory Handling” on page 365.

MEMFREE

Synopsis

```
MEMFREE(inout POINTER memory-pointer)
// Frees dynamically allocated memory.
```

Usage

Common to clients and servers.

Description

The `MEMFREE` function releases dynamically allocated memory, by means of a a pointer that was originally obtained by using `MEMALLOC`. Do not try to use this pointer after freeing it, because doing so might result in a runtime error.

Parameters

The parameter for `MEMFREE` can be described as follows:

`memory-pointer`	This is an `inout` parameter that contains a pointer to the allocated memory block.

Example

The following is an example of how to use `MEMFREE` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-MEMORY-BLOCK                    POINTER VALUE NULL.

PROCEDURE DIVISION.

    …
* Finished with the block of memory allocated by call to MEMALLOC
    CALL "MEMFREE" USING WS-MEMORY-BLOCK.
```

See also

"MEMALLOC" on page 443.

OBJDUP

Synopsis

```
OBJDUP(in POINTER object-reference,
       out POINTER duplicate-obj-ref)
// Duplicates an object reference.
```

Usage

Common to clients and servers.

Description

The `OBJDUP` function creates a duplicate reference to an object. It returns a new reference to the original object reference and increments the reference count of the object. It is equivalent to calling `CORBA::Object::_duplicate()` in C++. Because object references are opaque and ORB-dependent, your application cannot allocate storage for them. Therefore, if more than one copy of an object reference is required, you can use `OBJDUP` to create a duplicate.

Parameters

The parameters for `OBJDUP` can be described as follows:

`object-reference`	This is an `in` parameter that contains the valid object reference.
`duplicate-obj-ref`	This is an `out` parameter that contains the duplicate object reference.

Example

The following is an example of how to use `OBJDUP` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-SIMPLE-SIMPLEOBJECT           POINTER VALUE NULL.
01 WS-SIMPLE-SIMPLE0BJECT-COPY      POINTER VALUE NULL.

PROCEDURE DIVISION.
…
* Note that the object reference will have been created,
* for example, by a call to OBJNEW.
    CALL "OBJDUP" USING WS-SIMPLE-SIMPLEOBJECT
                        WS-SIMPLE-SIMPLEOBJECT-COPY.
    SET WS-OBJDUP TO TRUE.
    PERFORM CHECK-STATUS.
```

See also

- "OBJREL" on page 453.
- "Object References and Memory Management" on page 376.

OBJGETID

Synopsis

```
OBJGETID(in POINTER object-reference,
         out X(nn) object-id,
         in 9(09) BINARY object-id-length)
// Retrieves the object ID from an object reference.
```

Usage

Specific to batch servers. Not relevant to CICS or IMS.

Description

The `OBJGETID` function retrieves the object ID string from an object reference. It is equivalent to calling `POA::reference_to_id` in C++.

Parameters

The parameters for `OBJGETID` can be described as follows:

`object-reference`	This is an `in` parameter that contains the valid object reference.
`object-id`	This is an `out` parameter that is a bounded string containing the object name relating to the specified object reference. If this string is not large enough to contain the object name, the returned string is truncated.
`object-id-length`	This is an `in` parameter that specifies the length of the object name.

Exceptions

A `CORBA::BAD_PARAM::LENGTH_TOO_SMALL` exception is raised if the length of the string containing the object name is greater than the `object-id-length` parameter.

A `CORBA::BAD_PARAM::INVALID_OBJECT_ID` exception is raised if an Orbix 2.3 object reference is passed.

A `CORBA::BAD_INV_ORDER::SERVER_NAME_NOT_SET` exception is raised if `ORBSRVR` is not called.

Example

The following is an example of how to use `OBJGETID` in a client or server program:

```
WORKING-STORAGE SECTION.

01 WS-OBJECT-IDENTIFIER-LEN    PICTURE 9(09) BINARY VALUE 0.
01 WS-OBJECT-IDENTIFIER        PICTURE X(20) VALUE SPACES.
01 WS-OBJECT                   POINTER VALUE NULL.

PROCEDURE DIVISION.
…
* Note that the object reference will have been created, for
* example, by a call to OBJNEW.

    MOVE 20 TO WS-OBJECT-IDENTIFIER-LEN.
    CALL "OBJGETID" USING WS-OBJECT
                          WS-OBJECT-IDENTIFIER
                          WS-OBJECT-IDENTIFIER-LEN.
    SET WS-OBJGETID TO TRUE.
    PERFORM CHECK-STATUS.

    DISPLAY "Object identifier string equals "
        WS-OBJECT-IDENTIFIER.
```

OBJNEW

Synopsis

```
OBJNEW(in X(nn) server-name,
       in X(nn) interface-name,
       in X(nn) object-id,
       out POINTER object-reference)
// Creates a unique object reference.
```

Usage

Server-specific.

Description

The `OBJNEW` function creates a unique object reference that encapsulates the specified object identifier and interface names. The resulting reference can be returned to clients to initiate requests on that object. It is equivalent to calling `POA::create_reference_with_id` in C++.

Parameters

The parameters for `OBJNEW` can be described as follows:

`server-name`	This is an `in` parameter that is a bounded string containing the server name. This must be the same as the value passed to `ORBSRVR`. This string must be terminated by at least one space.
`interface-name`	This is an `in` parameter that is a bounded string containing the interface name. This must be the same as the value specified in the *`idlmembername`* and *`idlmembername`*`X` copybooks (that is, of the form `IDL:`*`name`*`:`*`version_number`*). This string must be terminated by at least one space.
`object-id`	This is an `in` parameter that is a bounded string containing the object identifier name relating to the specified object reference. This string must be terminated by at least one space.
`object-reference`	This is an out parameter that contains the created object reference.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
WORKING-STORAGE SECTION.

   01 WS-SERVER-NAME           PICTURE X(18) VALUE
                               "simple_persistent ".
   01 WS-SERVER-NAME-LEN      PICTURE 9(09) BINARY VALUE 17.

   01 WS-INTERFACE-NAME        PICTURE X(28) VALUE
       "IDL:Simple/SimpleObject:1.0 ".
   01 WS-OBJECT-IDENTIFIER     PICTURE X(17) VALUE
       "my_simple_object ".
   01 WS-SIMPLE-SIMPLEOBJECT   POINTER VALUE NULL.
PROCEDURE DIVISION.

    …
    CALL "OBJNEW"    USING WS-SERVER-NAME
                           WS-INTERFACE-NAME
                           WS-OBJECT-IDENTIFIER
                           WS-SIMPLE-SIMPLEOBJECT.
   SET WS-OBJNEW TO TRUE.
   PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::BAD_PARAM::INVALID_SERVER_NAME` exception is raised if the server name does not match the server name passed to `ORBSRVR`.

A CORBA::BAD_PARAM::NO_OBJECT_IDENTIFIER exception is raised if the parameter for the object identifier name is an invalid string.

A CORBA::BAD_INV_ORDER::INTERFACE_NOT_REGISTERED exception is raised if the specified interface has not been registered via ORBREG.

A CORBA::BAD_INV_ORDER::SERVER_NAME_NOT_SET exception is raised if ORBSRVR is not called.

OBJREL

Synopsis

```
OBJREL(inout POINTER object-reference)
// Releases an object reference.
```

Usage

Common to clients and servers.

Description

The `OBJREL` function indicates that the caller will no longer access the object reference. It is equivalent to calling `CORBA::release()` in C++. `OBJREL` decrements the reference count of the object reference.

Parameters

The parameter for `OBJREL` can be described as follows:

`object-reference`	This is an `inout` parameter that contains the valid object reference.

Example

The following is an example of how to use `OBJREL` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-SIMPLE-SIMPLEOBJECT              POINTER VALUE NULL.
01 WS-SIMPLE-SIMPLEOBJECT-COPY         POINTER VALUE NULL.

PROCEDURE DIVISION.
…
* Note that the object reference will have been created, for
* example, by a call to OBJNEW.

    CALL "OBJDUP" USING WS-SIMPLE-SIMPLE0BJECT
                        WS-SIMPLE-SIMPLEOBJECT-COPY.
    SET WS-OBJDUP TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "OBJREL" USING WS-SIMPLE-SIMPLEOBJECT-COPY.
    SET WS-OBJREL TO TRUE.
    PERFORM CHECK-STATUS.
```

See also

- "OBJDUP" on page 446.

- "Object References and Memory Management" on page 376.

OBJRIR

Synopsis

```
OBJRIR(in X(nn) desired-service,
       out POINTER object-reference)
// Returns an object reference to an object through which a
// service such as the Naming Service can be used.
```

Usage

Common to clients and servers. Not relevant to CICS or IMS.

Description

The `OBJRIR` function returns an object reference, through which a service (for example, the Interface Repository or a CORBAservice like the Naming Service) can be used. For example, the Naming Service is accessed by using a `desired-service` string with the "`NameService` " value. It is equivalent to calling `ORB::resolve_initial_services()` in C++.

Table 41 shows the common services available, along with the COBOL identifier assigned to each service. The COBOL identifiers are declared in the `CORBA` copybook.

Table 41: *Summary of Common Services and Their COBOL Identifiers*

Service	COBOL Identifier
InterfaceRepository	`IFR-SERVICE`
NameService	`NAMING-SERVICE`
TradingService	`TRADING-SERVICE`

Not all the services available in C++ are available in COBOL. Refer to the `list_initial_services` function in the *CORBA Programmer's Reference, C++* for details of all the available services.

Parameters

The parameters for `OBJRIR` can be described as follows:

`desired-service`	This is an `in` parameter that is a string specifying the desired service. This string is terminated by a space.
`object-reference`	This is an `out` parameter that contains an object reference for the desired service.

Example

The example can be broken down as follows:

1. The following code is defined in the supplied `CORBA` copybook:

```
01 SERVICE-REQUESTED            PICTURE X(20)
                                VALUE SPACES.
   88 IFR-SERVICE              VALUE "InterfaceRepository ".
   88 NAMING-SERVICE            VALUE "NameService ".
   88 TRADING-SERVICE           VALUE "TradingService ".
```

2. The following is an example of how to use `OBJRIR` in a client or server program:

```
WORKING-STORAGE SECTION
   01  WS-NAMESERVICE-OBJ POINTER VALUE NULL.
PROCEDURE DIVISION.

   …
   SET NAMING-SERVICE TO TRUE.
   CALL "OBJRIR"    USING SERVICE-REQUESTED
                          WS-NAMESERVICE-OBJ.
   SET WS-OBJRIR TO TRUE.
   PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::ORB::InvalidName` exception is raised if the `desired-service` string is invalid.

OBJTOSTR

Synopsis

```
OBJTOSTR(in POINTER object-reference,
         out POINTER object-string)
// Returns a stringified interoperable object reference (IOR)
// from a valid object reference.
```

Usage

Common to batch clients and servers. Not relevant to CICS or IMS.

Description

The `OBJTOSTR` function returns a string representation of an object reference. It translates an object reference into a string, and the resulting value can then be stored or communicated in whatever ways strings are manipulated.

A string representation of an object reference has an `IOR:` prefix followed by a series of hexadecimal octets. It is equivalent to calling `CORBA::ORB::object_to_string()` in C++.

Because an object reference is opaque and might differ from one ORB to the next, the object reference itself is not a convenient value for storing references to objects in persistent storage or for communicating references by means other than invocation.

Parameters

The parameters for `OBJTOSTR` can be described as follows:

`object-reference`	This is an `in` parameter that contains the object reference.
`object-string`	This is an `out` parameter that contains the stringified representation of the object reference (that is, the IOR).

Example

The following is an example of how to use OBJTOSTR in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-SIMPLE-SIMPLEOBJECT          POINTER VALUE NULL.
01 WS-IOR-PTR                      POINTER VALUE NULL.
01 WS-IOR-STRING                   PICTURE X(2048) VALUE SPACES.
01 WS-IOR-LEN                    PICTURE 9(09) BINARY VALUE 2048.

PROCEDURE DIVISION.
…
* Note that the object reference will have been created, for
* example, by a call to OBJNEW.

    CALL "OBJTOSTR" USING WS-SIMPLE-SIMPLEOBJECT
                          WS-IOR-PTR.
    SET WS-OBJTOSTR TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "STRGET" USING WS-IOR-PTR
                        WS-IOR-LEN
                        WS-IOR-STRING.
    SET WS-STRGET TO TRUE.
    PERFORM CHECK-STATUS.
    DISPLAY "Interoperable object reference (IOR) equals "
    WS-IOR-STRING.
```

See also

"STRTOOBJ" on page 514.

ORBARGS

Synopsis

```
ORBARGS(in X(nn) argument-string,
        in 9(09) BINARY argument-string-length,
        in X(nn) orb-name,
        in 9(09) BINARY orb-name-length)
// Initializes a client or server connection to an ORB.
```

Usage

Common to clients and servers.

Description

The `ORBARGS` function initializes a client or server connection to the ORB, by making a call to `CORBA::ORB_init()` in C++. It first initializes an application in the ORB environment and then it returns the ORB pseudo-object reference to the application for use in future ORB calls.

Because applications do not initially have an object on which to invoke ORB calls, `ORB_init()` is a bootstrap call into the CORBA environment. Therefore, the `ORB_init()` call is part of the `CORBA` module but is not part of the `CORBA::ORB` class.

The `arg-list` is optional and is usually not set. The use of the `orb-name` is recommended, because if it is not specified, a default ORB name is used.

The ORB identifier (specified via the `-ORBid` argument) is defined by the CORBA specification. It is intended to uniquely identify ORBs used within the same process in a multi-ORB application. The value specified for `-ORBid` is set on ORB initialization during the call to `CORBA::ORB_init()` in C++.

When you are assigning ORB identifiers via `ORBARGS`, if the `orb-name` parameter has a value, any `-ORBid` arguments in the `argv` are ignored. However, all other ORB arguments in `argv` might be significant during the ORB initialization process. If the `orb-name` parameter is null, the ORB identifier is obtained from the `-ORBid` argument of `argv`. If the `orb-name` is null and there is no `-ORBid` argument in `argv`, the default ORB is returned in the call.

Parameters

The parameters for `ORBARGS` can be described as follows:

`argument-string`	This is an `in` parameter that is a bounded string containing the argument list of the environment-specific data for the call. Refer to "ORB arguments" for more details.
`argument-string-length`	This is an `in` parameter that specifies the length of the argument string list.
`orb-name`	This is an `in` parameter that is a bounded string containing the ORB identifier for the initialized ORB, which must be unique for each server across a location domain. However, client-side ORBs and other "transient" ORBs do not register with the locator, so it does not matter what name they are assigned.
`orb-name-length`	This is an `in` parameter that specifies the length of the ORB identifier string.

ORB arguments

Each ORB argument is a sequence of configuration strings or options of the following form:

```
-ORBsuffix value
```

The suffix is the name of the ORB option being set. The value is the value to which the option is set. There must be a space between the suffix and the value. Any string in the argument list that is not in one of these formats is ignored by the `ORB_init()` method.

Valid ORB arguments include:

`-ORBboot_domain` *`value`*	This indicates where to get boot configuration information.
`-ORBdomain` *`value`*	This indicates where to get the ORB actual configuration information.
`-ORBid` *`value`*	This is the ORB identifier.

`-ORBname` *`value`*	This is specific to Orbix CORBA ORBs and is used to select a configuration scope from within a configuration domain. The value specified for `-ORBname` is also set on ORB initialization, based on the following logic: 1. If a `-ORBname` value is passed as a parameter to `ORBARGS`, use that value. 2. Check for the existence of the environment variable `IT_ORB_NAME`, and use its value if set. 3. Use the `-ORBid` value.

Example

The following is an example of how to use `ORBARGS` in a client or server program:

```
WORKING-STORAGE SECTION.
01 ARG-LIST                     PICTURE X(01) VALUE SPACES
01 ARG-LIST-LEN                 PICTURE 9(09) BINARY VALUE 0.
01 ORB-NAME                     PICTURE X(10) VALUE "simple_orb"
01 ORB-NAME-LEN                 PICTURE 9(09) BINARY VALUE 10.

PROCEDURE DIVISION.
…
    DISPLAY "Initializing the ORB".
    CALL "ORBARGS" USING ARG-LIST
                         ARG-LIST-LEN
                         ORB-NAME
                         ORB-NAME-LEN.
    SET WS-ORBARGS TO TRUE.
    PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::BAD_INV_ORDER::ADAPTER_ALREADY_INITIALIZED` exception is raised if `ORBARGS` is called more than once in a client or server.

ORBEXEC

Synopsis

```
ORBEXEC(in POINTER object-reference,
        in X(nn) operation-name,
        inout buffer operation-buffer,
        inout buffer user-exception-buffer)
// Invokes an operation on the specified object.
```

Usage

Client-specific.

Description

The `ORBEXEC` function allows a COBOL client to invoke operations on the server interface represented by the supplied object reference. All in and inout parameters must be set up prior to the call. `ORBEXEC` invokes the specified operation for the specified object, and marshals and populates the operation buffer, depending on whether they are `in`, `out`, `inout`, or `return` arguments.

As shown in the following example, the client can test for a user exception by examining the `EXCEPTION-ID` of the operation's `user-exception-buffer` parameter after calling `ORBEXEC`. A non-zero value indicates a user exception. A zero value indicates that no user exception was raised by the operation that the call to `ORBEXEC` invoked. If an exception is raised, you must reset the discriminator of the user exception block to zero before the next call. Refer to the following example for more details of how to do this.

> **Note:** The caller is blocked until either the request has been processed by the target object or an exception occurs. This is equivalent to `Request::invoke()` in C++.

Parameters

The parameters for `ORBEXEC` can be described as follows:

`object-reference`	This is an `in` parameter that contains the valid object reference. You can use `STRTOOBJ` to create this object reference.
`operation-name`	This is an `in` parameter that is a string containing the operation name to be invoked. This string is terminated by a space.

`operation-buffer`	This is an `inout` parameter that contains a COBOL `01` level data item representing the data types that the operation supports.
`user-exception-buffer`	This is an `in` parameter that contains the COBOL representation of the user exceptions that the operation supports, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler. If the IDL operation supports no user exceptions, a dummy buffer is generated—this dummy buffer is not populated on the server side, and it is only used as the fourth (in this case, dummy) parameter to `ORBEXEC`.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    typedef string<10> Aboundedstring;
    exception MyException  {Aboundedstring except_str; };
    Aboundedstring myoperation(in Aboundedstring instr,
        inout Aboundedstring inoutstr,
        out Aboundedstring outstr)
        raises(MyException);
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *`idlmembername`* copybook (where *`idlmembername`* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 30: *The idlmembername Copybook (Sheet 1 of 3)*

```
***********************************************************
* Operation:       myoperation
* Mapped name:     myoperation
* Arguments:       <in> sample/Aboundedstring instr
*                  <inout> sample/Aboundedstring inoutstr
*                  <out> sample/Aboundedstring outstr
* Returns:         sample/Aboundedstring
* User Exceptions: sample/MyException
```

Example 30: *The idlmembername Copybook (Sheet 2 of 3)*

```
**********************************************************
* operation-buffer
01 SAMPLE-MYOPERATION-ARGS.
   03 INSTR                                PICTURE X(10).
   03 INOUTSTR                             PICTURE X(10).
   03 OUTSTR                               PICTURE X(10).
   03 RESULT                               PICTURE X(10).

********************************************************
COPY EXAMPLX.
********************************************************

**********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************

* The operation-name and its corresponding 88 level entry
01 SAMPLE-OPERATION                        PICTURE X(27).
   88 SAMPLE-MYOPERATION                   VALUE
        "myoperation:IDL:sample:1.0".
01 SAMPLE-OPERATION-LENGTH                 PICTURE 9(09)
                                           BINARY VALUE 27.
********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************

01 EXAMPLE-TYPE                            PICTURE X(29).
  COPY CORBATYP.
   88 SAMPLE-ABOUNDEDSTRING                VALUE
         "IDL:sample/Aboundedstring:1.0".
01 EXAMPLE-TYPE-LENGTH                     PICTURE S9(09)
                                           BINARY VALUE 29.

***********************************************************
* User exception block
***********************************************************
01 EX-SAMPLE-MYEXCEPTION                   PICTURE X(26)
                                           VALUE
```

Example 30: *The idlmembername Copybook (Sheet 3 of 3)*

```
    "IDL:sample/MyException:1.0".
01 EX-SAMPLE-MYEXCEPTION-LENGTH           PICTURE 9(09)
                                          BINARY VALUE 26.

* user exception buffer
01 EXAMPLE-USER-EXCEPTIONS.
   03 EXCEPTION-ID                        POINTER
                                          VALUE NULL.
   03 D                                   PICTURE 9(10) BINARY
                                          VALUE 0.
      88 D-NO-USEREXCEPTION               VALUE 0.
      88 D-SAMPLE-MYEXCEPTION             VALUE 1.
   03 U                                   PICTURE X(10)
                                          VALUE LOW-VALUES.
   03 EXCEPTION-SAMPLE-MYEXCEPTION        REDEFINES U.
      05 EXCEPT-STR                       PICTURE X(10).
```

3. The following is an example of how to use `ORBEXEC` in a client program:

Example 31: *Using ORBEXEC in the Client Program (Sheet 1 of 2)*

```
WORKING-STORAGE SECTION.
 01 WS-SAMPLE-OBJ               POINTER VALUE NULL.
 01 WS-EXCEPT-ID-STR            PICTURE X(200) VALUES SPACES.

 PROCEDURE DIVISION.
 …
*The SAMPLE-OBJ will have been created
*with a previous call to api STRTOOBJ

       SET SAMPLE-MYOPERATION   TO TRUE
           DISPLAY "invoking Simple::" SAMPLE-OPERATION.
* populate the in arguments
           MOVE "Hello " TO INSTR OF SAMPLE-MYOPERATION-ARGS.
* populate the inout arguments

          MOVE "Server " TO INOUTSTR OF SAMPLE-MYOPERATION-ARGS.

           CALL "ORBEXEC"   USING WS-SAMPLE-OBJ
                                  SAMPLE-OPERATION
                                  SAMPLE-MYOPERATION-ARGS
                                  SAMPLE-USER-EXCEPTIONS.
           SET WS-ORBEXEC TO TRUE.
           PERFORM CHECK-STATUS.
* check if user exceptions thrown
```

Example 31: *Using ORBEXEC in the Client Program (Sheet 2 of 2)*

```
           EVALUATE TRUE
           WHEN D-NO-USEREXCEPTION
* no exception
* check inout arguments
            DISPLAY "In out parameter returned equals "
            INOUTSTR OF SAMPLE-MYOPERATION-ARGS
* check out arguments
            DISPLAY "Out parameter returned equals "
            OUTSTR OF SAMPLE-MYOPERATION-ARGS
* check return arguments
            DISPLAY "Return parameter returned equals "
            RESULT OF SAMPLE-MYOPERATION-ARGS
* MYEXCEPTION rasied by the server
          WHEN D-SAMPLE-MYEXCEPTION
              MOVE SPACES TO WS-EXCEPT-ID-STRING
*retrieve  string value form the exception-id pointer
     CALL "STRGET" USING EXCEPTION-ID OF
                         SAMPLE-USER-EXCEPTIONS
                         EX-SAMPLE-MYEXCEPTION-LENGTH
                         WS-EXCEPT-ID-STRING
     DISPLAY "Exception id equals "
     WS-EXCEPT-ID-STRING

*Check  the values of the returned exception which
*in this example is a bounded string
     DISPLAY "Exception value retuned "
     EXCEPT-STR    OF EXAMPLE-USER-EXCEPTIONS
     CALL "STRFREE" EXCEPTION-ID OF SAMPLE-USER-EXCEPTIONS
     SET WS-STRFREE TO TRUE
     PERFORM CHECK-STATUS
* Initialize for the next ORBEXEC call
    SET D-NO-USEREXCEPTION TO TRUE
     END-EVALUATE.
```

Exceptions

A CORBA::BAD_INV_ORDER::INTERFACE_NOT_REGISTERED exception is raised if the client tries to invoke an operation on an interface that has not been registered via ORBREG.

A CORBA::BAD_PARAM::INVALID_DISCRIMINATOR_TYPECODE exception is raised if the discriminator typecode is invalid when marshalling a union type.

A CORBA::BAD_PARAM::UNKNOWN_OPERATION exception is raised if the operation is not valid for the interface.

A CORBA::BAD_PARAM::UNKNOWN_TYPECODE exception is raised if the typecode cannot be determined when marshalling an any type or a user exception.

A CORBA::DATA_CONVERSION::VALUE_OUT_OF_RANGE exception is raised if the value is determined to be out of range when marshalling a long, short, unsigned short, unsigned long, long long, or unsigned long long type.

See also

- "COAGET" on page 426.
- "COAPUT" on page 431.
- The BANK demonstration in *orbixhlq*.DEMO.CBL.SRC for a complete example of how to use ORBEXEC.

ORBHOST

Synopsis

```
ORBHOST(in 9(09) BINARY hostname-length,
        out X(nn) hostname)
// Returns the hostname of the server
```

Usage

Specific to batch servers. Not relevant to CICS or IMS.

Description

The `ORBHOST` function returns the hostname of the machine on which the server is running.

Note: This is only applicable if TCP/IP is being used on the host machine.

Parameters

The parameters for `ORBEXEC` can be described as follows:

`hostname-length`	This is an `in` parameter that specifies the length of the hostname.
`hostname`	This is an `out` parameter that is a bounded string used to retrieve the hostname.

Example

The following is an example of how to use `ORBHOST` in a server program:

```
WORKING-STORAGE SECTION.
01 HOST-NAME                        PICTURE X(255).
01 HOST-NAME-LEN                    PICTURE 9(09) BINARY
                                    VALUE 255.

PROCEDURE DIVISION.
…
    CALL "ORBHOST" USING HOST-NAME-LENGTH
                         HOST-NAME.
    SET WS-ORBHOST TO TRUE.
    PERFORM CHECK-STATUS.
    DISPLAY "Hostname equals " HOST-NAME
```

Exceptions

A `CORBA::BAD_PARAM::LENGTH_TOO_SMALL` exception is raised if the length of the string containing the hostname is greater than the `hostname-length` parameter.

ORBREG

Synopsis

```
ORBREG(in buffer interface-description)
// Describes an IDL interface to the COBOL runtime.
```

Usage

Common to clients and servers.

Description

The `ORBREG` function registers an interface with the COBOL runtime, by using the interface description that is stored in the *`idlmembername`*`X` copybook generated by the Orbix IDL compiler. Each interface within the IDL member has a `01` level, which is the parameter to be passed to the `ORBREG` call.

The Orbix 2000 IDL compiler generates a `01` level in the *`idlmembername`*`X` copybook for each interface in the IDL member. Each `01` level that is generated fully describes the interface to the COBOL runtime; for example, the interface name, what it inherits from, each operation, its parameters and user exceptions, and all the associated typecodes. The *`idlmembername`*`X` copybook cannot be amended by the user, because doing so can cause unpredictable results at runtime.

You must call `ORBREG` for every interface that the client or server uses. However, it is to be called only once for each interface; therefore, you should place the calls in the client and server mainline programs.

Parameters

The parameter for `ORBREG` can be described as follows:

`interface-description`	This is an `in` parameter that contains the address of the interface definition, which is defined as a `01` level in the *`idlmembername`*`X` copybook.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
module Simple
{
    interface SimpleObject
    {
        void
        call_me();
    };
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername*X copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
 01 SIMPLE-SIMPLEOBJECT-INTERFACE.
        03 FILLER PIC X(160) VALUE X"0000005C00000058C9C4D37
-            "AE2899497938561E28994979385D682918583A37AF14BF
-            "000000000040000000EC9C4D37AE2899497938561E2899
-            "4979385D682918583A37AF14BF0000000001E289949793
-            "85D682918583A300FFFFFF00000004C9C4D37AE2899497
-            "938561E28994979385D682918583A37AF14BF000000000
-            "180000000000000000001838193936D948500000000000000000
-             "00000000000000000000".
```

3. The following is an example of how to use `ORBREG` in a client or server program:

```
WORKING-STORAGE SECTION.

       COPY SIMPLE.

PROCEDURE DIVISION.
* Register interface(s) after ORB initialization
           DISPLAY "Registering the Interface".

           CALL "ORBREG"    USING
   SIMPLE-SIMPLEOBJECT-INTERFACE.
           SET WS-ORBREG TO TRUE.
           PERFORM CHECK-STATUS
```

Exceptions

A `CORBA::BAD_INV_ORDER::INTERFACE_ALREADY_REGISTERED` exception is raised if the client or server attempts to register the same interface more than once.

ORBSRVR

Synopsis

```
ORBSRVR(in X(nn) server-name,
        in 9(09) BINARY server-name-length)
// Sets the server name for the current server process.
```

Usage

Server-specific.

Description

The ORBSRVR function sets the server name for the current server. This should be contained in the server mainline program, and should be called only once, after calling ORBARGS.

Parameters

The parameters for ORBSRVR can be described as follows:

server-name	This is an in parameter that is a bounded string containing the server name.
server-name-length	This is an in parameter that specifies the length of the string containing the server name.

Example

The following is an example of how to use ORBSRVR in a server program:

```
WORKING-STORAGE SECTION.
01 SERVER-NAME          PICTURE X(17) VALUE "simple_persistent".
01 SERVER-NAME-LEN       PICTURE 9(09) BINARY VALUE 17.
…
PROCEDURE DIVISION.
…
* After ORBARGS call.
    CALL "ORBSRVR" USING SERVER-NAME
                         SERVER-NAME-LEN.
    SET WS-ORBSRVR TO TRUE.
    PERFORM CHECK-STATUS.
```

Exceptions

A CORBA::BAD_INV_ORDER::SERVER_NAME_ALREADY_SET exception is raised if ORBSRVR is called more than once.

ORBSTAT

Synopsis

```
ORBSTAT(in buffer status-buffer)
// Registers the status information block.
```

Usage

Common to both clients and servers.

Description

The ORBSTAT function registers the supplied status information block to the COBOL runtime. The status of any COBOL runtime call can then be checked, for example, to test if a call has completed successfully.

The ORBIX-STATUS-INFORMATION structure is defined in the supplied CORBA copybook. A copybook called CHKERRS (for batch), CERRSMFA (for IMS or CICS servers), CHKCLCIC (for CICS clients), and CHKCLIMS (for IMS clients) is also provided, which contains a CHECK-STATUS function that can be called after each API call, to check if a system exception has occurred. Alternatively, this can be modified or replaced for the system environment.

You should call ORBSTAT once, as the first API call, in your server mainline and client programs. If it is not called, and an exception occurs at runtime, the application terminates with the following message:

```
An exception has occurred but ORBSTAT has not been called.
Place the ORBSTAT API call in your application, compile and
rerun. Exiting now.
```

Parameters

The parameters for ORBSTAT can be described as follows:

status-buffer	This is an in parameter that contains a COBOL 01 level data item representing the status information block defined in the CORBA copybook. This buffer is populated when a CORBA system exception occurs during subsequent API calls. Refer to "Definition of status information block" for more details of how it is defined.

Definition of status information block

ORBIX-STATUS-INFORMATION is defined in the CORBA copybook as follows:

Example 32: *ORBIX-STATUS-INFORMATION Definition (Sheet 1 of 2)*

```
*
**  This data item must be originally set by calling the
**  ORBSTAT api.
**  This data item is then used to determine the status of
**  each api called (eg COAGET, ORBEXEC).
**
**  If the call was successful then CORBA-EXCEPTION and
**  CORBA-MINOR-CODE will be both set to 0 and
**  COMPLETION-STATUS-YES will be set to true.
**
**  EXCEPTION-TEXT is a pointer to the text of the exception.
**  STRGET must be used to extract this text.
**  (Refer to CHKERRS or CERRSMFA Copybooks for more details).
*
01 ORBIX-STATUS-INFORMATION IS EXTERNAL.
    03 CORBA-EXCEPTION                  PICTURE 9(5) BINARY.
       88 CORBA-NO-EXCEPTION            VALUE 0.
       88 CORBA-UNKNOWN                 VALUE 1.
       88 CORBA-BAD-PARAM               VALUE 2.
       88 CORBA-NO-MEMORY               VALUE 3.
       88 CORBA-IMP-LIMIT               VALUE 4.
       88 CORBA-COMM-FAILURE            VALUE 5.
       88 CORBA-INV-OBJREF              VALUE 6.
       88 CORBA-NO-PERMISSION           VALUE 7.
       88 CORBA-INTERNAL                VALUE 8.
       88 CORBA-MARSHAL                 VALUE 9.
       88 CORBA-INITIALIZE              VALUE 10.
       88 CORBA-NO-IMPLEMENT            VALUE 11.
       88 CORBA-BAD-TYPECODE            VALUE 12.
       88 CORBA-BAD-OPERATION           VALUE 13.
       88 CORBA-NO-RESOURCES            VALUE 14.
       88 CORBA-NO-RESPONSE             VALUE 15.
       88 CORBA-PERSIST-STORE           VALUE 16.
       88 CORBA-BAD-INV-ORDER           VALUE 17.
       88 CORBA-TRANSIENT               VALUE 18.
       88 CORBA-FREE-MEM                VALUE 19.
       88 CORBA-INV-IDENT               VALUE 20.
       88 CORBA-INV-FLAG                VALUE 21.
       88 CORBA-INTF-REPOS              VALUE 22.
       88 CORBA-BAD-CONTEXT             VALUE 23.
       88 CORBA-OBJ-ADAPTER             VALUE 24.
```

Example 32: *ORBIX-STATUS-INFORMATION Definition (Sheet 2 of 2)*

```
      88 CORBA-DATA-CONVERSION         VALUE 25.
      88 CORBA-OBJECT-NOT-EXIST        VALUE 26.
      88 CORBA-TRANSACTION-REQUIRED    VALUE 27.
      88 CORBA-TRANSACTION-ROLLEDBACK  VALUE 28.
      88 CORBA-INVALID-TRANSACTION     VALUE 29.
      88 CORBA-INV-POLICY              VALUE 30.
      88 CORBA-REBIND                  VALUE 31.
      88 CORBA-TIMEOUT                 VALUE 32.
      88 CORBA-TRANSACTION-UNAVAILABLE VALUE 33.
      88 CORBA-TRANSACTION-MODE        VALUE 34.
      88 CORBA-BAD-QOS                 VALUE 35.
      88 CORBA-CODESET-INCOMPATIBLE    VALUE 36.
   03 COMPLETION-STATUS                PICTURE 9(5) BINARY
      88 COMPLETION-STATUS-YES         VALUE 0.
      88 COMPLETION-STATUS-NO          VALUE 1.
      88 COMPLETION-STATUS-MAYBE       VALUE 2.
   03 EXCEPTION-MINOR-CODE             PICTURE S9(10) BINARY
   03 EXCEPTION-NUMBER REDEFINES EXCEPTION-MINOR-CODE
                                       PICTURE S9(10) BINARY.
   03 EXCEPTION-TEXT                   USAGE IS POINTER
```

Example

The following is an example of how to use `ORBSTAT` in a server mainline or client program:

```
WORKING-STORAGE SECTION.
    COPY CORBA
…
PROCEDURE DIVISION.

    CALL "ORBSTAT" USING ORBIX-STATUS-INFORMATION.

    DISPLAY "Initializing the ORB".

    CALL "ORBARGS" USING ARG-LIST
                         ARG-LIST-LEN
                         ORB-NAME
                         ORB-NAME-LEN.
    SET WS-ORBARGS TO TRUE.
    PERFORM CHECK-STATUS.
…
EXIT-PRG.
    STOP RUN.
…
COPY CHKERRS.
```

Note: The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

Exceptions

A `CORBA::BAD_INV_ORDER::STAT_ALREADY_CALLED` exception is raised if `ORBSTAT` is called more than once with a different `ORBIX-STATUS-INFORMATION` block.

ORBTIME

Synopsis

```
ORBTIME(in 9(04) BINARY timeout-type
        in 9(09) BINARY timeout-value)
// Used by clients for setting the call timeout.
// Used by servers for setting the event timeout.
```

Usage

Common to batch clients and servers. Not relevant to CICS or IMS.

Description

The `ORBTIME` function provides:

- Call timeout support to clients. This means that it specifies how long before a client should be timed out after having established a connection with a server. The value only comes into effect after the connection has been established.
- Event timeout support to servers. This means that it specifies how long a server should wait between connection requests.

Parameters

The parameters for `ORBTIME` can be described as follows:

`timeout-type`	This is an `in` parameter that determines whether call timeout or event timeout functionality is required. It must be set to one of the two values defined in the `CORBA` copybook for the `ORBIX-TIMEOUT-TYPE`. In this case, value `1` corresponds to event timeout, and value `2` corresponds to call timeout.
`timeout-value`	This is an `in` parameter that specifies the timeout value in milliseconds.

Server example

On the server side, ORBTIME must be called immediately before calling COARUN. After COARUN has been called, the event timeout value cannot be changed. For example:

```
…
01 WS-TIMEOUT-VALUE             PICTURE 9(09) BINARY VALUE 0.
…
PROCEDURE DIVISION.
…
*set the timeout value to two minutes
MOVE 120000 TO WS-TIMEOUT-VALUE
SET EVENT-TIMEOUT TO TRUE.
CALL "ORBTIME" USING ORBIX-TIMEOUT-TYPE
                     WS-TIMEOUT-VALUE.
SET WS-ORBTIME TO TRUE.
PERFORM CHECK-STATUS.
CALL "COARUN".
…
```

Client example

On the client side, ORBTIME must be called before calling ORBEXEC. For example:

```
…
*set the timeout value to two minutes
MOVE 120000 TO WS-TIMEOUT-VALUE
SET CALL-TIMEOUT TO TRUE.
CALL "ORBTIME" USING ORBIX-TIMEOUT-TYPE
                     WS-TIMEOUT-VALUE.
SET WS-ORBTIME TO TRUE.
PERFORM CHECK-STATUS.
CALL "ORBEXEC" …
```

Exceptions

A CORBA::BAD_PARAM::INVALID_TIMEOUT_TYPE exception is raised if the timeout-type parameter is not set to one of the two values defined for ORBIX-TIMEOUT-TYPE in the CORBA copybook.

ORBTXNB

Synopsis

```
ORBTXNB
// Indicates the beginning of a two-phase commit transaction
```

Usage

Client-specific. Only supported for CICS and IMS clients.

Description

The `ORBTXNB` function marks the beginning of two-phase commit processing. Any update calls to servers, made using `ORBEXEC` after a call to `ORBTXNB`, send data over a sync level 2 APPC conversation. This allows for committing or rolling back the updates made using `ORBEXEC`.

Parameters

`ORBTXNB` takes no parameters.

Example

The following is an example of how to call `ORBTXNB`:

```
…
CALL "ORBTXNB".
SET WS-ORBTXNB TO TRUE.
PERFORM CHECK-STATUS.
…
```

ORBTXNE

Synopsis

```
ORBTXNE
// Indicates the end of a two-phase commit transaction
```

Usage

Client-specific. Only supported for CICS and IMS clients.

Description

The `ORBTXNE` function marks the end of two-phase commit processing. This function requests that the sync level 2 APPC conversation is deallocated.

Very little processing should take place after this call. There should be no more calls to `ORBEXEC`.

Parameters

`ORBTXNE` takes no parameters.

Example

The following is an example of how to call `ORBTXNB`:

```
…
CALL "ORBTXNE".
SET WS-ORBTXNE TO TRUE.
PERFORM CHECK-STATUS.
…
```

SEQALLOC

Synopsis

```
SEQALLOC(in 9(09) BINARY sequence-size,
         in X(nn) typecode-key,
         in 9(09) BINARY typecode-key-length,
         inout buffer sequence-control-data)
// Allocates memory for an unbounded sequence
```

Usage

Common to clients and servers.

Description

The `SEQALLOC` function allocates initial storage for an unbounded sequence. You must call `SEQALLOC` before you call `SEQSET` for the first time. The length supplied to the function is the initial sequence size requested. The typecode supplied to `SEQALLOC` must be the sequence typecode.

Note: You can use `SEQALLOC` only on unbounded sequences.

Parameters

The parameters for `SEQALLOC` can be described as follows:

`sequence-size`	This is an `in` parameter that specifies the maximum expected size of the sequence.
`typecode-key`	This is an `in` parameter that contains a `01` level data item representing the typecode key, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler. This is a bounded string.
`typecode-key-length`	This is an `in` parameter that specifies the length of the typecode key, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler.
`sequence-control-data`	This is an `inout` parameter that contains the unbounded sequence control data.

Note: The typecode keys are defined as level `88` data items in the *`idlmembername`* copybook generated by the Orbix IDL compiler.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long> unboundedseq;
   unboundedseq myop();
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 33: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       None
* Returns:         example/unboundedseq
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 RESULT-1.
      05 RESULT                          PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM                PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-LENGTH                 PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-BUFFER                 POINTER
                                         VALUE NULL.
      05 SEQUENCE-TYPE                   POINTER
                                         VALUE NULL.
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************
01 EXAMPLE-OPERATION                     PICTURE X(21).
```

Example 33: *The idlmembername Copybook (Sheet 2 of 2)*

```
   88 EXAMPLE-MYOP                             VALUE
      "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH                    PICTURE 9(09) BINARY
                                               VALUE 21.
***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************
01 EXAMPLE-TYPE                                PICTURE X(28).
     COPY CORBATYP.
   88 EXAMPLE-UNBOUNDEDSEQ                     VALUE
      "IDL:example/unboundedseq:1.0".
   88 EXAMPLE                                  VALUE
      "IDL:example:1.0".
01 EXAMPLE-TYPE-LENGTH                         PICTURE S9(09)
                                               BINARY VALUE 28.
```

3. The following is an example of how to use `SEQALLOC` in a client or server program:

Example 34: *Using SEQALLOC in Client or Server (Sheet 1 of 2)*

```
WORKING-STORAGE SECTION.
01 WS-MAX-ELEMENTS                             PICTURE 9(09) BINARY
                                               VALUE 10.
01 WS-CURRENT-ELEMENT                          PICTURE 9(09) BINARY
                                               VALUE 0.
      DO-EXAMPLE-MYOP.
          CALL "COAGET" USING EXAMPLE-MYOP-ARGS.
          SET WS-COAGET TO TRUE.
          PERFORM CHECK-STATUS.
     * initialize the maximum and length fields.

     *    MOVE WS-MAX-ELEMENTS TO SEQUENCE-MAXIMUM OF
          MOVE 0               TO SEQUENCE-MAXIMUM OF
                                  EXAMPLE-MYOP-ARGS.
          MOVE 0               TO SEQUENCE-LENGTH OF
                                  EXAMPLE-MYOP-ARGS.

     * Initialize the sequence element data
          MOVE 0 TO RESULT OF
                    RESULT-1 OF
```

Example 34: *Using SEQALLOC in Client or Server (Sheet 2 of 2)*

```
                        EXAMPLE-MYOP-ARGS.
      * set the typecode of the sequence
           SET EXAMPLE-UNBOUNDEDSEQ TO TRUE.
      * Allocate memory for the unbounded sequence.
      * NOTE: SEQUENCE-MAXIMUM is set to WS-MAX-ELEMENTS after
      *       SEQALLOC call
           CALL "SEQALLOC" USING WS-MAX-ELEMENTS
                                 EXAMPLE-TYPE
                                 EXAMPLE-TYPE-LENGTH
                                 RESULT-SEQUENCE OF
                                 EXAMPLE-MYOP-ARGS.
           SET WS-SEQALLOC TO TRUE.
           PERFORM CHECK-STATUS.
      * Now ready to populate the seqeunce see SEQSET
***********************************************************
* Check Errors Copybook
**********************************************************
       COPY CHKERRS.
```

Note: The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

Exceptions

A `CORBA::NO_MEMORY` exception is raised if there is not enough memory available to complete the request. In this case, the pointer will contain a null value.

A `CORBA::BAD_PARAM::INVALID_SEQUENCE` exception is raised if the sequence has not been set up correctly.

See also

- "SEQFREE" on page 491.
- "Unbounded Sequences and Memory Management" on page 367.

SEQDUP

Synopsis

```
SEQDUP(in buffer sequence-control-data,
       out buffer dupl-seq-control-data)
// Duplicates an unbounded sequence control block.
```

Usage

Common to clients and servers.

Description

The `SEQDUP` function creates a copy of an unbounded sequence. The new sequence has the same attributes as the original sequence. The sequence data is copied into a newly allocated buffer. The program owns this allocated buffer. When this buffer is no longer required, you must call `SEQFREE` to free the memory allocated to it.

You can call `SEQDUP` only on unbounded sequences.

Parameters

The parameters for `SEQDUP` can be described as follows:

`sequence-control-data`	This is an `in` parameter that contains the unbounded sequence control data.
`dupl-seq-control-data`	This is an `out` parameter that contains the duplicated unbounded sequence control data block.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface example
{
   typedef sequence<long> unboundedseq;
   unboundedseq myop();
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 35: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       None
* Returns:         example/unboundedseq
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 RESULT-1.
      05 RESULT                         PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM               PICTURE 9(09) BINARY
                                        VALUE 0.
      05 SEQUENCE-LENGTH                PICTURE 9(09) BINARY
                                        VALUE 0.
      05 SEQUENCE-BUFFER                POINTER
                                        VALUE NULL.
      05 SEQUENCE-TYPE                  POINTER
                                        VALUE NULL.
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
***********************************************************

01 EXAMPLE-OPERATION                   PICTURE X(21).
   88 EXAMPLE-MYOP                     VALUE
                                       "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH            PICTURE 9(09) BINARY
                                       VALUE 21.
***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************
```

Example 35: *The idlmembername Copybook (Sheet 2 of 2)*

```
01 EXAMPLE-TYPE                          PICTURE X(28).
    COPY CORBATYP.
   88 EXAMPLE-UNBOUNDEDSEQ               VALUE
       "IDL:example/unboundedseq:1.0".
   88 EXAMPLE                            VALUE
       "IDL:example:1.0".
01 EXAMPLE-TYPE-LENGTH                   PICTURE S9(09) BINARY
                                         VALUE 28.
```

3. The following is an example of how to use `SEQDUP` in a client or server program:

Example 36: *Using SEQDUP in Client or Server (Sheet 1 of 2)*

```
WORKING-STORAGE SECTION.
01 WS-CURRENT-ELEMENT                    PICTURE 9(09) BINARY
                                         VALUE 0.
01 WS-ARGS.
   03 COPIED-1.
      05 COPIED-VALUE                    PICTURE S9(10) BINARY.
   03 COPIED-SEQUENCE.
      05 SEQUENCE-MAXIMUM                PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-LENGTH                 PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-BUFFER                 POINTER
                                         VALUE NULL.
      05 SEQUENCE-TYPE                   POINTER
                                         VALUE NULL.

PROCEDURE DIVISION.

    CALL "ORBEXEC"   USING EXAMPLE-OBJ
                           EXAMPLE-OPERATION
                           EXAMPLE-MYOP-ARGS
                           EXAMPLE-USER-EXCEPTIONS.
    SET WS-ORBEXEC TO TRUE.
    PERFORM CHECK-STATUS.
    * Make a copy of the unbounded sequence
     CALL "SEQDUP" USING RESULT-SEQUENCE OF
                         EXAMPLE-MYOP-ARGS
                         COPIED-SEQUENCE OF
                         WS-ARGS.
     SET WS-SEQDUP TO TRUE.
```

Example 36: *Using SEQDUP in Client or Server (Sheet 2 of 2)*

```
           PERFORM CHECK-STATUS.

         * Release the memory  allocated by SEQALLOC
         * Refer to memory management chapter on when to call this
         * api. * NOTE: The SEQUENCE-MAXIMUM and SEQUENCE-LENGTH
         * are not initialized.

           CALL "SEQFREE" USING RESULT-SEQUENCE OF
                                EXAMPLE-MYOP-ARGS.
           SET WS-SEQFREE TO TRUE.
           PERFORM CHECK-STATUS.

         * Get each of the 10 elements in the copied  sequence.
           PERFORM VARYING WS-CURRENT-ELEMENT
               FROM 1 BY 1 UNTIL
               WS-CURRENT-ELEMENT >
               SEQUENCE-LENGTH OF
               WS-ARGS
         * Get the current element in the copied sequence
           CALL "SEQGET" USING COPIED-SEQUENCE OF
                               WS-ARGS
                               WS-CURRENT-ELEMENT
                               COPIED-VALUE OF
                               COPIED-1 OF
                               WS-ARGS
           SET WS-SEQGET TO TRUE
           PERFORM CHECK-STATUS
           DISPLAY "Element data value equals "
               COPIED-VALUE OF
               COPIED-1 OF
               WS-ARGS

           END-PERFORM.

         EXIT-PRG.
         =========.
           STOP RUN.
      ***********************************************************
      * Check Errors Copybook
      ***********************************************************
      COPY CHKERRS.
```

> **Note:** The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

Exceptions

A `CORBA::BAD_PARAM::INVALID_SEQUENCE` exception is raised if the sequence has not been set up correctly.

See also

- "SEQFREE" on page 491.
- "Unbounded Sequences and Memory Management" on page 367.

SEQFREE

Synopsis

```
SEQFREE(inout buffer sequence-control-data)
// Frees the memory allocated to an unbounded sequence.
```

Usage

Common to clients and servers.

Description

The `SEQFREE` function releases storage assigned to an unbounded sequence. (Storage is assigned to a sequence by calling `SEQALLOC`.) Do not try to use the sequence again after freeing its memory, because doing so might result in a runtime error.

You can use `SEQFREE` only on unbounded sequences. Refer to the "Memory Handling" on page 365 for details of when it should be called.

Parameters

The parameter for `SEQFREE` can be described as follows:

`sequence-control-data`	This is an `inout` parameter that contains the unbounded sequence control data.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long> unboundedseq;
   unboundedseq myop();
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 37: *The idlmembername Copybook (Sheet 1 of 2)*

Example 37: *The idlmembername Copybook (Sheet 2 of 2)*

```
***********************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       None
* Returns:         example/unboundedseq
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 RESULT-1.
      05 RESULT                          PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM                PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-LENGTH                 PICTURE 9(09) BINARY
                                         VALUE 0.
      05 SEQUENCE-BUFFER                 POINTER
                                         VALUE NULL.
      05 SEQUENCE-TYPE                   POINTER
                                         VALUE NULL.
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************
01 EXAMPLE-OPERATION                     PICTURE X(21).
   88 EXAMPLE-MYOP                       VALUE
      "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH              PICTURE 9(09) BINARY
                                         VALUE 21.
***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************
01 EXAMPLE-TYPE                           PICTURE X(28).
     COPY CORBATYP.
   88 EXAMPLE-UNBOUNDEDSEQ                VALUE
      "IDL:example/unboundedseq:1.0".
   88 EXAMPLE                             VALUE
      "IDL:example:1.0".
01 EXAMPLE-TYPE-LENGTH                    PICTURE S9(09)
                                          BINARY VALUE 28.
```

3. The following is an example of how to use `SEQFREE` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-MAX-ELEMENTS                    PICTURE 9(09) BINARY
                                        VALUE 10.
01 WS-CURRENT-ELEMENT                 PICTURE 9(09) BINARY
                                        VALUE 0.

* Release the memory  allocated by SEQALLOC
* Refer to memory management chapter on when to call this
* api.
* NOTE: The SEQUENCE-MAXIMUM and SEQUENCE-LENGTH are
*       not initialized.
    CALL "SEQFREE" USING RESULT-SEQUENCE OF
                         EXAMPLE-MYOP-ARGS.
    SET WS-SEQFREE TO TRUE.
    PERFORM CHECK-STATUS.

**********************************************************
* Check Errors Copybook
**********************************************************
     COPY CHKERRS.
```

Note: The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

See also "Unbounded Sequences and Memory Management" on page 367.

SEQGET

Synopsis

```
SEQGET(in sequence sequence-control-data,
       in 9(09) BINARY element-number,
       out buffer sequence-data)
// Retrieves the specified element from an unbounded sequence.
```

Usage

Common to clients and servers.

Description

The `SEQGET` function provides access to a specific element of an unbounded sequence. The data is copied from the sequence into the element buffer associated with this sequence (that is, into the `sequence-data` parameter).

> **Note:** This copy is a shallow copy, so pointers to dynamic areas should be handled with care.

You can use `SEQGET` only on unbounded sequences.

Parameters

The parameter for `SEQGET` can be described as follows:

`sequence-control-data`	This is an `in` parameter that contains the unbounded sequence control data.
`element-number`	This is an `in` parameter that specifies the index of the element number to be retrieved.
`sequence-data`	This is an `out` parameter that contains the buffer to which the sequence data is to be copied.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long> unboundedseq;
   unboundedseq myop();
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the `idlmembername` copybook (where `idlmembername` represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 38: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:        myop
* Mapped name:      myop
* Arguments:        None
* Returns:          example/unboundedseq
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 RESULT-1.
      05 RESULT                        PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM              PICTURE 9(09) BINARY
                                       VALUE 0.
      05 SEQUENCE-LENGTH               PICTURE 9(09) BINARY
                                       VALUE 0.
      05 SEQUENCE-BUFFER               POINTER
                                       VALUE NULL.
      05 SEQUENCE-TYPE                 POINTER
                                       VALUE NULL.
***********************************************************
*
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
**********************************************************
01 EXAMPLE-OPERATION                   PICTURE X(21).
   88 EXAMPLE-MYOP                     VALUE
      "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH            PICTURE 9(09) BINARY
                                       VALUE 21.
***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
**********************************************************
01 EXAMPLE-TYPE                         PICTURE X(28).
     COPY CORBATYP.
```

Example 38: *The idlmembername Copybook (Sheet 2 of 2)*

```
   88 EXAMPLE-UNBOUNDEDSEQ                    VALUE
        "IDL:example/unboundedseq:1.0".
   88 EXAMPLE                                 VALUE
        "IDL:example:1.0".
01 EXAMPLE-TYPE-LENGTH                        PICTURE S9(09)
                                              BINARY VALUE 28.
```

3. The following is an example of how to use `SEQGET` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-MAX-ELEMENTS                        PICTURE 9(09) BINARY
                                            VALUE 10.
01 WS-CURRENT-ELEMENT                     PICTURE 9(09) BINARY
                                            VALUE 0.

CALL "ORBEXEC"   USING EXAMPLE-OBJ
                       EXAMPLE-OPERATION
                       EXAMPLE-MYOP-ARGS
                       EXAMPLE-USER-EXCEPTIONS.
SET WS-ORBEXEC TO TRUE.
PERFORM CHECK-STATUS.
* Get each of the 10 elements in the sequence.
PERFORM VARYING WS-CURRENT-ELEMENT
                FROM 1 BY 1 UNTIL
                WS-CURRENT-ELEMENT >
                SEQUENCE-LENGTH OF
                EXAMPLE-MYOP-ARGS
* Get the current element
CALL "SEQGET" USING RESULT-SEQUENCE OF
                    EXAMPLE-MYOP-ARGS
                    WS-CURRENT-ELEMENT
                    RESULT OF
                    RESULT-1 OF
                    EXAMPLE-MYOP-ARGS
SET WS-SEQGET TO TRUE
```

Exceptions

A `CORBA::BAD_PARAM::INVALID_SEQUENCE` exception is raised if the sequence has not been set up correctly.

A `CORBA::BAD_PARAM::INVALID_BOUNDS` exception is raised if the element to be accessed is either set to `0` or greater than the current length.

SEQSET

Synopsis

```
SEQSET(out buffer sequence-control-data,
       in 9(09) BINARY element-number,
       in buffer sequence-data)
// Places the specified data into the specified element of an
// unbounded sequence.
```

Usage

Common to clients and servers.

Description

The `SEQSET` function copies the supplied data from the element buffer area (that is, from the `sequence data` parameter) into the sequence at the specified element position. You can set any element ranging between `1` and the current length of a sequence plus one. If the current length plus one is greater than the maximum size of the sequence, the sequence is reallocated to hold the enlarged sequence.

> **Note:** `SEQSET` performs a deep copy from the element buffer area to the sequence area. To avoid leaks, the element buffer area should be freed of any dynamically allocated data following a call to `SEQSET`.

You can call `SEQSET` only on unbounded sequences.

The algorithm used by `SEQSET` to determine the new maximum size of the sequence, whenever necessary, is:

```
max_seq_size = SEQMAX(sequence_control_data)

if element_number > max_seq_size then
    if max_seq_size < 8192 then
        new_max_seq_size = max_seq_size * 2
    else
        new_max_seq_size = max_seq_size + (max_seq_size/8)
    end
end
```

Parameters

The parameters for `SEQSET` can be described as follows:

`sequence-control-data` This is an `out` parameter that contains the unbounded sequence control data.

`element-number`	This is an `in` parameter that specifies the index of the element number that is to be set.
`sequence-data`	This is an `in` parameter that contains the address of the buffer containing the data that is to be placed in the sequence.

Example

1. Consider the following IDL:

```
// IDL
interface example
{
   typedef sequence<long> unboundedseq;
   unboundedseq myop();
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *`idlmembername`* copybook (where *`idlmembername`* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

Example 39: *The idlmembername Copybook (Sheet 1 of 2)*

```
***********************************************************
* Operation:       myop
* Mapped name:     myop
* Arguments:       None
* Returns:         example/unboundedseq
* User Exceptions: none
***********************************************************
01 EXAMPLE-MYOP-ARGS.
   03 RESULT-1.
      05 RESULT                      PICTURE S9(10) BINARY.
   03 RESULT-SEQUENCE.
      05 SEQUENCE-MAXIMUM            PICTURE 9(09) BINARY
                                     VALUE 0.
      05 SEQUENCE-LENGTH             PICTURE 9(09) BINARY
                                     VALUE 0.
      05 SEQUENCE-BUFFER             POINTER
                                     VALUE NULL.
      05 SEQUENCE-TYPE               POINTER
                                     VALUE NULL.
***********************************************************
*
```

Example 39: *The idlmembername Copybook (Sheet 2 of 2)*

```
* Operation List section
* This lists the operations and attributes which an
* interface supports
*
***********************************************************
01 EXAMPLE-OPERATION                     PICTURE X(21).
   88 EXAMPLE-MYOP                       VALUE
      "myop:IDL:example:1.0".
01 EXAMPLE-OPERATION-LENGTH              PICTURE 9(09) BINARY
                                         VALUE 21.
************************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
***********************************************************
01 EXAMPLE-TYPE                           PICTURE X(28).
  COPY CORBATYP.
   88 EXAMPLE-UNBOUNDEDSEQ                VALUE
        "IDL:example/unboundedseq:1.0".
   88 EXAMPLE                             VALUE
        "IDL:example:1.0".
01 EXAMPLE-TYPE-LENGTH                    PICTURE S9(09)
                                          BINARY VALUE 28.
```

3. The following is an example of how to use `SEQSET` in a client or server program:

Example 40: *Using SEQSET in Client or Server (Sheet 1 of 3)*

```
WORKING-STORAGE SECTION.
01 WS-MAX-ELEMENTS                        PICTURE 9(09) BINARY
                                          VALUE 10.
01 WS-CURRENT-ELEMENT                     PICTURE 9(09) BINARY
                                          VALUE 0.

 DO-EXAMPLE-MYOP.
     CALL "COAGET" USING EXAMPLE-MYOP-ARGS.
     SET WS-COAGET TO TRUE.
     PERFORM CHECK-STATUS.
* initialize the maximum and length fields.

*     MOVE WS-MAX-ELEMENTS TO SEQUENCE-MAXIMUM OF
      MOVE 0               TO SEQUENCE-MAXIMUM OF
```

Example 40: *Using SEQSET in Client or Server (Sheet 2 of 3)*

```
                           EXAMPLE-MYOP-ARGS.
      MOVE 0               TO SEQUENCE-LENGTH OF
                           EXAMPLE-MYOP-ARGS.

* Initialize the sequence element data
       MOVE 0 TO RESULT OF
                 RESULT-1 OF
                 EXAMPLE-MYOP-ARGS.
* set the typecode of the sequence
       SET EXAMPLE-UNBOUNDEDSEQ TO TRUE.
* Allocate memory for the unbounded sequence.
* NOTE: SEQUENCE-MAXIMUM is set to WS-MAX-ELEMENTS
* after SEQALLOC call.
   CALL "SEQALLOC" USING WS-MAX-ELEMENTS
                         EXAMPLE-TYPE
                         EXAMPLE-TYPE-LENGTH
                         RESULT-SEQUENCE OF
                         EXAMPLE-MYOP-ARGS.
   SET WS-SEQALLOC TO TRUE.
   PERFORM CHECK-STATUS.
* Set each of the 10 elements in the sequence.
   PERFORM VARYING WS-CURRENT-ELEMENT
                   FROM 1 BY 1 UNTIL
                   WS-CURRENT-ELEMENT >
                   SEQUENCE-MAXIMUM OF
                   EXAMPLE-MYOP-ARGS
* initialize  the element data
    ADD 2 TO            RESULT OF
                        RESULT-1 OF
                        EXAMPLE-MYOP-ARGS
    DISPLAY "Element data value equals "
                        RESULT OF
                        RESULT-1 OF
                        EXAMPLE-MYOP-ARGS

* Set the current element to the element data buffer
* NOTE: SEQUENCE-LENGTH is incremented on each seqset
    CALL "SEQSET" USING RESULT-SEQUENCE OF
                        EXAMPLE-MYOP-ARGS
                        WS-CURRENT-ELEMENT
                        RESULT OF
                        RESULT-1 OF
                        EXAMPLE-MYOP-ARGS
    SET WS-SEQSET TO TRUE
    PERFORM CHECK-STATUS
```

Example 40: *Using SEQSET in Client or Server (Sheet 3 of 3)*

```
    END-PERFORM.

    CALL "COAPUT" USING EXAMPLE-MYOP-ARGS.
    SET WS-COAPUT TO TRUE.
    PERFORM CHECK-STATUS.

***********************************************************
* Check Errors Copybook
************************************************************
COPY CHKERRS.
```

Note: The `COPY CHKERRS` statement in the preceding example is used in batch programs. It is replaced with `COPY CERRSMFA` in IMS or CICS server programs, `COPY CHKCLCIC` in CICS client programs, and `COPY CHKCLIMS` in IMS client programs.

Exceptions

A `CORBA::BAD_PARAM::INVALID_SEQUENCE` exception is raised if the sequence has not been set up correctly. For example, if an invalid sequence typecode was passed to `SEQSET` or if the sequence is a bounded sequence.

A `CORBA::BAD_PARAM::INVALID_BOUNDS` exception is raised if the element to be accessed is either set to `0` or greater than the current length of the sequence plus one.

A `CORBA::NO_MEMORY` exception is raised if the sequence needs to be resized and there is not enough memory to resize it.

STRFREE

Synopsis

```
STRFREE(in POINTER string-pointer)
// Frees the memory allocated to a bounded string.
```

Usage

Common to clients and servers.

Description

The `STRFREE` function releases dynamically allocated memory for an unbounded string, via a pointer that was originally obtained by calling `STRSET`. Do not try to use the unbounded string after freeing it, because doing so might result in a runtime error. Refer to "Memory Handling" on page 365 for more details.

Parameters

The parameters for `STRFREE` can be described as follows:

`string-pointer`	This is an `in` parameter that is the unbounded string pointer containing a copy of the bounded string.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
interface sample {
    typedef string astring;
    attribute astring mystring;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
***********************************************************
* Attribute:    mystring
* Mapped name:  mystring
* Type:        sample/astring (read/write)
***********************************************************

01 SAMPLE-MYSTRING-ARGS.
   03 RESULT                                POINTER
                                            VALUE NULL.
```

3. The following is an example of how to use STRFREE in a client or server program:

```
 PROCEDURE DIVISION.
    …
* note the string pointer will have been set
* by a call to STRSET/STRSETP
     CALL "STRFREE" USING RESULT OF SAMPLE-MYSTRING-ARGS.

     DISPLAY "The memory is now released".
```

See also "STRSET" on page 509.

STRGET

Synopsis

```
STRGET(in POINTER string-pointer,
       in 9(09) BINARY string-length,
       out X(nn) string)
// Copies the contents of an unbounded string to a bounded string.
```

Usage

Common to clients and servers.

Description

The `STRGET` function copies the characters in the unbounded string pointer, `string-pointer`, to the `string` item. If the `string-pointer` parameter does not contain enough characters to exactly fill the target string, the target string is terminated by a space. If there are too many characters in the `string-pointer`, the excess characters are not copied to the target string.

> **Note:** Null characters are never copied from the `string-pointer` to the target string.

The number of characters copied depends on the length parameter. This must be a valid positive integer (that is, greater than zero); otherwise, a runtime error occurs. If the `X(nn)` data item is shorter than the length field, the string is still copied, but obviously cannot contain the intended string.

Parameters

The parameters for `STRGET` can be described as follows:

`string-pointer`	This is an `in` parameter that is the unbounded string pointer containing a copy of the unbounded string.
`string-length`	This is an `in` parameter that specifies the length of the unbounded string.
`string`	This is an `out` parameter that is a bounded string to which the contents of the string pointer are copied. This string is terminated by a space if it is larger than the contents of the string pointer.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    typedef string astring;
    attribute astring mystring;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
***********************************************************
* Attribute:    mystring
* Mapped name:  mystring
* Type:        sample/astring (read/write)
***********************************************************

   01 SAMPLE-MYSTRING-ARGS.
    03 RESULT                                POINTER
                                             VALUE NULL.
```

3. The following is an example of how to use `STRGET` in a client or server program:

```
WORKING-STORAGE SECTION.

 01 WS-BOUNDED-STRING       PICTURE X(20) VALUE SPACES.
 01 WS-BOUNDED-STRING-LEN   PICTURE 9(09) BINARY VALUE 20.

 PROCEDURE DIVISION.

* note the string pointer will have been set
* by a call to STRSET/STRSETP
    …
     CALL "STRGET" USING RESULT OF MYSTRING-ARGS
                         WS-BOUNDED-STRING-LEN
                         WS-BOUNDED-STRING.
     SET WS-STRGET TO TRUE.
     PERFORM CHECK-STATUS.
    DISPLAY "Bounded string now retrieved and value equals "
          WS-BOUNDED-STRING.
```

STRLEN

Synopsis

```
STRLEN(in POINTER string-pointer,
       out 9(09) BINARY string-length)
// Returns the actual length of an unbounded string.
```

Usage

Common to clients and servers.

Description

The `STRLEN` function returns the number of characters in an unbounded string.

Parameters

The parameters for `STRLEN` can be described as follows:

`string-pointer`	This is an `in` parameter that is the unbounded string pointer containing the unbounded string.
`string-length`	This is an `out` parameter that is used to retrieve the actual length of the string that the `string-pointer` contains.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    typedef string astring;
    attribute astring mystring;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
*************************************************************
* Attribute:    mystring
* Mapped name:  mystring
* Type:        sample/astring (read/write)
*************************************************************

   01 SAMPLE-MYSTRING-ARGS.
    03 RESULT                                  POINTER
                                               VALUE NULL.
```

3. The following is an example of how to use `STRLEN` in a client or server program:

```
WORKING-STORAGE SECTION.

 01 WS-BOUNDED-STRING-LEN   PICTURE 9(09) BINARY VALUE 0.

 PROCEDURE DIVISION.
    ...
* note the string pointer will have been set
* by a call to STRSET/STRSETP
     CALL "STRLEN" USING RESULT OF MYSTRING-ARGS
                         WS-BOUNDED-STRING-LEN.

     DISPLAY "The String length equals  set".
         WS-BOUNDED-STRING-LEN
```

STRSET

Synopsis

```
STRSET(out POINTER string-pointer,
       in 9(09) BINARY string-length,
       in X(nn) string)
// Creates a dynamic string from a PIC X(n) data item
```

Usage

Common to clients and servers

Description

The `STRSET` function creates an unbounded string to which it copies the number of characters specified in `length` from the bounded string specified in `string`. If the bounded string contains trailing spaces, these are not copied to the target unbounded string whose memory location is specified by `string-pointer`.

The `STRSETP` version of this function is identical, except that it does copy trailing spaces. You can use the `STRFREE` to subsequently free this allocated memory.

The number of characters copied depends on the length parameter. This must be a valid positive integer (that is, greater than zero); otherwise, a runtime error occurs. If the `X(nn)` data item is shorter than the length field, the string is still copied, but obviously cannot contain the intended string.

Note: `STRSET` allocates memory for the string from the program heap at runtime. Refer to "STRFREE" on page 502 and "Unbounded Strings and Memory Management" on page 372 for details of how this memory is subsequently released.

Parameters

The parameters for `STRSET` can be described as follows:

`string-pointer`	This is an `out` parameter to which the unbounded string is copied.
`string-length`	This is an `in` parameter that specifies the number of characters to be copied from the bounded string specified in `string`.

`string`	This is an `in` parameter containing the bounded string that is to be copied. This string is terminated by a space if it is larger than the contents of the target string pointer. If the bounded string contains trailing spaces, they are not copied.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    typedef string astring;
    attribute astring mystring;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
***********************************************************
* Attribute:    mystring
* Mapped name:  mystring
* Type:        sample/astring (read/write)
***********************************************************

   01 SAMPLE-MYSTRING-ARGS.
    03 RESULT                                POINTER
                                             VALUE NULL.
```

3. The following is an example of how to use `STRSET` in a client or server program:

```
WORKING-STORAGE SECTION.

 01 WS-BOUNDED-STRING         PICTURE X(20) VALUE SPACES.
 01 WS-BOUNDED-STRING-LEN     PICTURE 9(09) BINARY VALUE 20.

 PROCEDURE DIVISION.
    ...
* Note trailing spaces are not copied.
     MOVE "JOE BLOGGS" TO WS-BOUNDED-STRING.
     CALL "STRSET" USING RESULT OF SAMPLE-MYSTRING-ARGS
                         WS-BOUNDED-STRING-LEN
                         WS-BOUNDED-STRING.
     SET WS-STRSET TO TRUE.
     PERFORM CHECK-STATUS.

     DISPLAY "String pointer is now set".
```

See also

- "STRFREE" on page 502.
- "Unbounded Strings and Memory Management" on page 372.

STRSETP

Synopsis

```
STRSETP(out POINTER string-pointer,
        in 9(09) BINARY string-length,
        in X(nn) string)
// Creates a dynamic string from a PIC X(n) data item.
```

Usage

Common to clients and servers.

Description

The `STRSETP` function is exactly the same as `STRSET`, except that `STRSETP` does copy trailing spaces to the unbounded string. Refer to "STRSET" on page 509 for more details.

Note: `STRSETP` allocates memory for the string from the program heap at runtime. Refer to "STRFREE" on page 502 and "Unbounded Strings and Memory Management" on page 372 for details of how this memory is subsequently released.

Example

The example can be broken down as follows

1. Consider the following IDL:

```
//IDL
interface sample
{
    typedef string astring;
    attribute  astring mystring;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
*****************************************************************
* Attribute:    mystring
* Mapped name:  mystring
* Type:         sample/astring (read/write)
*****************************************************************

 01 SAMPLE-MYSTRING-ARGS.
    03 RESULT                                       POINTER
                                                    VALUE NULL.
```

3. The following is an example of how to use STRSETP in a client or server program:

```
WORKING-STORAGE SECTION.

 01 WS-BOUNDED-STRING       PICTURE X(20) VALUE SPACES.
 01 WS-BOUNDED-STRING-LEN   PICTURE 9(09) BINARY VALUE 20.

 PROCEDURE DIVISION.
    …
* Note trailing spaces are copied.
     MOVE "JOE BLOGGS" TO WS-BOUNDED-STRING.
     CALL "STRSETP" USING RESULT OF MYSTRING-ARGS
                          WS-BOUNDED-STRING-LEN
                          WS-BOUNDED-STRING.
     SET WS-STRSETP TO TRUE.
     PERFORM CHECK-STATUS.

     DISPLAY "String pointer is now set".
```

See also

- “STRFREE” on page 502.
- “Unbounded Strings and Memory Management” on page 372.

STRTOOBJ

Synopsis

```
STRTOOBJ(in POINTER object-string,
       out POINTER object-reference)
// Creates an object reference from an interoperable object
// reference (IOR).
```

Usage

Common to clients and servers.

Description

The `STRTOOBJ` function creates an object reference from an unbounded string. When a client has called `STRTOOBJ` to create an object reference, the client can then invoke operations on the server.

Parameters

The parameters for `STRTOOBJ` can be described as follows:

`object-string`	This is an `in` parameter that contains a pointer to the address in memory where the interoperable object reference is held.
`object-reference`	This is an `out` parameter that contains a pointer to the address in memory where the returned object reference is held.

Format for input string

The `object-string` input parameter can take different forms, as follows:

- Stringified interoperable object reference (IOR)

  The CORBA specification defines the representation of stringified IOR references, so this form is interoperable across all ORBs that support IIOP. For example:

  ```
  IOR:000…
  ```

  You can use the supplied `iordump` utility to parse the IOR. The `iordump` utility is available with your Orbix Mainframe installation on z/OS UNIX System Services.

- corbaloc:rir URL

  This is one of two possible formats relating to the corbaloc mechanism. The corbaloc mechanism uses a human-readable string to identify a target object. A corbaloc:rir URL can be used to represent an object reference. It defines a key upon which `resolve_initial_references` is called (that is, it is equivalent to calling `OBJRIR`).

The format of a corbaloc:rir URL is `corbaloc:rir:/`*`rir-argument`* (for example, `"corbaloc:rir:/NameService"`). See the *CORBA Programmer's Guide, C++* for more details on the operation of `resolve_initial_references`.

- corbaloc:iiop-address URL

  This is the second of two possible formats relating to the corbaloc mechanism. A corbaloc:iiop-address URL is used to identify named-keys.

  The format of a corbaloc:iiop-address URL is `corbaloc:`*`iiop-address`*`[,`*`iiop-address`*`]…/`*`key-string`* (for example, `"corbaloc:iiop:xyz.com/BankService"`).

- itmfaloc URL

  The itmfaloc URL facilitates locating IMS and CICS adapter objects. Using an itmfaloc URL is similar to using the `itadmin mfa resolve` command; except that the imfaloc URL exposes this functionality directly to Orbix applications.

  The format of an itmfaloc URL is `itmfaloc:`*`itmfaloc-argument`* (for example, `"itmfaloc:Simple/SimpleObject"`). See the *CICS Adapters Administrator's Guide* and the *IMS Adapters Administrator's Guide* for details on the operation of itmfaloc URLs.

Stringified IOR example

Consider the following example of a client program that first shows how the server's object reference is retrieved via STRTOOBJ, and then shows how the object reference is subsequently used:

```
WORKING-STORAGE SECTION.
* Normally not stored in Working storage - this is just for
demonstration.
01 WS-SIMPLE-IOR PIC X(2048) VALUE
   "IOR:010000001c00000049444c3a53696d706c652f53696d706c654f626a
   6563743a312e300001000000000000007e000000010102000a0000006a757
   87461706f736500e803330000003a3e023231096a75787461706f73651273
   696d706c655f706572736973746656e7400106d795f73696d706c655f6f626
   a6563740002000000010000001800000001000000010001000000000000001
   01000100000000090101000600000006000000010000002100"
   01 WS-SIMPLE-SIMPLEOBJECT POINTER VALUE NULL.

* Set the COBOL pointer to point to the IOR string
* Normally read from a file
    CALL "STRSET" USING IOR-REC-PTR
                        IOR-REC-LEN
                        WS-SIMPLE-IOR.
    SET WS-STRSET TO TRUE.
    PERFORM CHECK-STATUS.
* Obtain object reference from the IOR
    CALL "STRTOOBJ" USING IOR-REC-PTR
                          WS-SIMPLE-SIMPLEOBJECT
    SET WS-STRTOOBJ TO TRUE.
    PERFORM CHECK-STATUS.
```

corbaloc:rir URL example

Consider the following example that uses a corbaloc to call `resolve_initial_references` on the Naming Service:

```
01 WS-CORBALOC-STR PICTURE X(26) VALUE
   "corbaloc:rir:/NameService ".
01 WS-CORBALOC-PTR  POINTER VALUE NULL.
01 WS-CORBALOC-STR-LENGTH PICTURE 9(9) BINARY VALUE 26.
01 WS-NAMING-SERVICE-OBJ POINTER VALUE NULL.

/* Create an unbounded corbaloc string to Naming Service */
CALL "STRSET" USING WS-CORBALOC-PTR
                    WS-CORBALOC-STR-LENGTH
                    WS-CORBALOC-STR.

SET WS-STRSET TO TRUE.
PERFORM CHECK-STATUS.
/* Create an object reference using the unbounded corbaloc str */
CALL "STRTOOBJ" USING WS-CORBALOC-PTR
                      WS-NAMING-SERVICE-OBJ.
SET WS-STRTOOBJ TO TRUE.
PERFORM CHECK-STATUS.
/* Can now invoke on naming service */
```

corbaloc:iiop-address URL example

You can use `STRTOOBJ` to resolve a named key. A named key, in essence, associates a string identifier with an object reference. This allows access to the named key via the string identifier. Named key pairings are stored by the locator. The following is an example of how to create a named key:

```
itadmin named_key create -key TestObjectNK IOR:…
```

Consider the following example that shows how to use `STR2TOOBJ` to resolve this named key:

```
itadmin named_key create -key TestObjectNK IOR:…
01 WS-CORBALOC-STR PICTURE X(46)
VALUE  "corbaloc:iiop:1.2@localhost:5001/TestObjectNK ".
01 WS-CORBALOC-PTR POINTER VALUE NULL.
01 WS-CORBALOC-STR-LENGTH PICTURE 9(9) BINARY VALUE 46.
01 WS-TEST-OBJECT-OBJ POINTER VALUE NULL.
/* Create an unbounded corbaloc string to the Test Object */
CALL "STRSET" USING WS-CORBALOC-PTR
                    WS-CORBALOC-STR-LENGTH
                    WS-CORBALOC-STR.

SET WS-STRSET TO TRUE.
PERFORM CHECK-STATUS.

/* Create an object reference using the unbounded corbaloc str */
CALL "STRTOOBJ" USING WS-CORBALOC-PTR
                      WS-TEST-OBJECT-OBJ.
SET WS-STRTOOBJ TO TRUE.
PERFORM CHECK-STATUS.

/* Can now invoke on TestObject */
```

itmfaloc URL example

You can use `STRTOOBJ` to locate IMS and CICS server objects via the itmfaloc mechanism. To use an itmfaloc URL, ensure that the configuration scope used contains a valid initial reference for the adapter that is to be used. You can do this in either of the following ways:

- Ensure that the `LOCAL_MFA_REFERENCE` in your Orbix configuration contains an object reference for the adapter you want to use.
- Use either `"-ORBname iona_services.imsa"` or `"-ORBname iona_services.cicsa"` to explicitly pass across a domain that defines `IT_MFA` initial references.

In essence, an itmfaloc URL allows programmatic access to `itadmin mfa resolve` functionality.

Consider the following example that shows how to locate IMS and CICS server objects via the itmfaloc URL mechanism:

```
01 WS-CORBALOC-STR PICTURE X(29)
VALUE  "itmfaloc:Simple/SimpleObject ".
01 WS-CORBALOC-PTR POINTER.
01 WS-CORBALOC-STR-LENGTH  PICTURE 9(9) BINARY  VALUE 29.
01 WS-TEST-OBJECT-OBJ POINTER VALUE NULL.

* Create an unbounded corbaloc string to the
* Simple/SimpleObject interface defined to an IMS/CICS
* adapter
CALL "STRSET" USING WS-CORBALOC-PTR
                    WS-CORBALOC-STR-LENGTH
                    WS-CORBALOC-STR.
SET WS-STRSET TO TRUE.
PERFORM CHECK-STATUS.
* Create an object reference using the unbounded corbaloc str
CALL "STRTOOBJ" USING WS-CORBALOC-PTR
                      WS-TEST-OBJECT-OBJ.
SET WS-STRTOOBJ TO TRUE.
PERFORM CHECK-STATUS.
* Can now invoke on Simple/SimpleObject
```

See also "OBJTOSTR" on page 457.

TYPEGET

Synopsis

```
TYPEGET(inout POINTER any-pointer,
        in 9(09) BINARY typecode-key-length,
        out X(nn) typecode-key)
// Extracts the type name from an any.
```

Usage

Common to clients and servers.

Description

The `TYPEGET` function returns the typecode of the value of the `any`. You can then use the typecode to ensure that the correct buffer is passed to the `ANYGET` function for extracting the value of the `any`.

Parameters

The parameters for `TYPEGET` can be described as follows:

`any-pointer`	This is an `inout` parameter that is a pointer to the address in memory where the `any` is stored.
`typecode-key-length`	This is an `in` parameter that specifies the length of the typecode key, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler.
`typecode-key`	This is an `out` parameter that contains a `01` level data item to which the typecode key is copied. This is defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler. This is a bounded string.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    attribute any myany;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the *idlmembername* copybook (where *idlmembername* represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
01 SAMPLE-MYANY-ARGS.
   03 RESULT                                POINTER
                                            VALUE NULL.
…
01 EXAMPLE-TYPE                             PICTURE X(15).
     COPY CORBATYP.
   88 SAMPLE                                VALUE
         "IDL:sample:1.0".
01 EXAMPLE-TYPE-LENGTH                    PICTURE S9(09) BINARY
                                            VALUE 22.
```

3. The following is an example of how to use `TYPEGET` in a client or server program:

```
WORKING-STORAGE SECTION.
  01 WS-DATA              PIC S9(5) VALUE 0.

CALL "TYPEGET" USING RESULT OF SAMPLE-MYANY-ARGS
                      EXAMPLE-TYPE-LENGTH
                      EXAMPLE-TYPE.
SET WS-TYPEGET TO TRUE.
PERFORM CHECK-STATUS.
* validate typecode
 EVALUATE TRUE
    WHEN CORBA-TYPE-SHORT
*retrieve the ANY  CORBA::Short value
    CALL "ANYGET" USING RESULT OF SAMPLE-MYANY-ARGS
                         WS-DATA
    SET WS-ANYGET TO TRUE
    PERFORM CHECK-STATUS
    DISPLAY "ANY value equals " WS-DATA.
    WHEN OTHER
         DISPLAY "Wrong typecode received, expected a SHORT
             typecode "
 END-EVALUATE.
```

Exceptions

A `CORBA::BAD_INV_ORDER::TYPESET_NOT_CALLED` exception is raised if the typecode of the `any` has not been set via `TYPESET`.

TYPESET

Synopsis

```
TYPESET(inout POINTER any-pointer,
        in 9(09) BINARY typecode-key-length,
        in X(nn) typecode-key)
// Sets the type name of an any.
```

Description

The `TYPESET` function sets the type of the `any` to the supplied typecode. You must call `TYPESET` before you call `ANYSET`, because `ANYSET` uses the current typecode information to insert the data into the `any`.

Parameters

The parameters for `TYPESET` can be described as follows:

`any-type`	This is an `inout` parameter that is a pointer to the address in memory where the `any` is stored.
`typecode-key-length`	This is an `in` parameter that specifies the length of the typecode string, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler.
`typecode-key`	This is an `in` parameter containing the typecode string representation, as defined in the *`idlmembername`* copybook generated by the Orbix IDL compiler. The appropriate `88` level item is set for the typecode to be used.

Example

The example can be broken down as follows:

1. Consider the following IDL:

```
// IDL
interface sample
{
    attribute any myany;
};
```

2. Based on the preceding IDL, the Orbix IDL compiler generates the following code in the `idlmembername` copybook (where `idlmembername` represents the (possibly abbreviated) name of the IDL member that contains the IDL definitions):

```
01 SAMPLE-MYANY-ARGS.
    03 RESULT                              POINTER
                                           VALUE NULL.
***********************************************************
*
* Typecode section
* This contains CDR encodings of necessary typecodes.
*
***********************************************************

01 EXAMPLE-TYPE                            PICTURE X(15).
COPY CORBATYP.
   88 SAMPLE                               VALUE
       "IDL:sample:1.0".
01 EXAMPLE-TYPE-LENGTH                     PICTURE S9(09)
                                           BINARY VALUE 22.
```

3. The following is an example of how to use `TYPESET` in a client or server program:

```
WORKING-STORAGE SECTION.
01 WS-DATA                                 PIC S9(5) VALUE 0.

PROCEDURE DIVISION.
…
* Set the ANY typecode to be a CORBA::ShortLong
  SET CORBA-TYPE-SHORT TO TRUE.
  CALL "TYPESET"   USING RESULT OF
                         SAMPLE-MYANY-ARGS
                         EXAMPLE-TYPE-LENGTH
                         EXAMPLE-TYPE.
  SET WS-TYPESET TO TRUE.
  PERFORM CHECK-STATUS.
```

Exceptions

A `CORBA::BAD_PARAM::UNKNOWN_TYPECODE` exception is raised if the typecode cannot be determined from the typecode key passed to `TYPESET`.

See also

- "ANYFREE" on page 414.

- "The any Type and Memory Management" on page 380.

WSTRFREE

Synopsis

```
WSTRFREE(in POINTER widestring-pointer)
// Frees the memory allocated to a bounded wide string.
```

Usage

Common to clients and servers.

Description

The `WSTRFREE` function releases dynamically allocated memory for an unbounded wide string, via a pointer that was originally obtained by calling `WSTRSET`. Do not try to use the unbounded wide string after freeing it, because doing so might result in a runtime error. Refer to the "Memory Handling" on page 365 for more details.

Parameters

The parameter for `WSTRGET` can be described as follows:

`widestring-pointer`	This is an `in` parameter that is the unbounded wide string pointer containing a copy of the bounded wide string.

WSTRGET

Synopsis

```
WSTRGET(in POINTER widestring-pointer,
        in 9(09) BINARY widestring-length,
        out G(nn) widestring)
// Copies the contents of an unbounded wide string to a bounded
// wide string.
```

Usage

Common to clients and servers.

Description

The `WSTRGET` function copies the characters in the unbounded wide string pointer, `string_pointer`, to the COBOL `PIC X(n)` wide string item. If the `string_pointer` parameter does not contain enough characters to exactly fill the target wide string, the target wide string is terminated by a space. If there are too many characters in the `string-pointer`, the excess characters are not copied to the target wide string.

Note: Null characters are never copied from the `string-pointer` to the target wide string.

Parameters

The parameters for `WSTRGET` can be described as follows:

`widestring-pointer`	This is an `in` parameter that is the unbounded wide string pointer containing a copy of the unbounded wide string.
`widestring-length`	This is an `in` parameter that specifies the length of the unbounded wide string.
`widestring`	This is an `out` parameter that is a bounded wide string to which the contents of the wide string pointer are copied. This wide string is terminated by a space if it is larger than the contents of the wide string pointer.

WSTRLEN

Synopsis

```
WSTRLEN(in POINTER widestring-pointer,
        out 9(09) BINARY widestring-length)
// Returns the actual length of an unbounded wide string.
```

Usage

Common to clients and servers.

Description

The `WSTRLEN` function returns the number of characters in an unbounded wide string.

Parameters

The parameters for `WSTRLEN` can be described as follows:

`widestring-pointer`	This is an `in` parameter that is the unbounded wide string pointer containing the unbounded wide string.
`widestring-length`	This is an `out` parameter that is used to retrieve the actual length of the wide string that the `string-pointer` contains.

WSTRSET

Synopsis

```
WSTRSET(out POINTER widestring-pointer,
        in 9(09) BINARY widestring-length,
        in G(nn) widestring)
// Creates a dynamic wide string from a PIC G(n) data item
```

Usage

Common to clients and servers

Description

The `WSTRSET` function creates an unbounded wide string to which it copies the number of characters specified in `length` from the bounded wide string specified in `string`. If the bounded wide string contains trailing spaces, these are not copied to the target unbounded wide string whose memory location is specified by `string-pointer`.

The `WSTRSETP` version of this function is identical, except that it does copy trailing spaces. You can use the `WSTRFREE` to subsequently free this allocated memory.

Parameters

The parameters for `WSTRSET` can be described as follows:

`widestring-pointer`	This is an `out` parameter to which the unbounded string is copied.
`widestring-length`	This is an `in` parameter that specifies the number of characters to be copied from the bounded string specified in `string`.
`widestring`	This is an `in` parameter containing the bounded string that is to be copied. This string is terminated by a space if it is larger than the contents of the target string pointer. If the bounded string contains trailing spaces, they are not copied.

WSTRSETP

Synopsis

```
WSTRSETP(out POINTER widestring-pointer,
         in 9(09) BINARY widestring-length,
         in G(nn) widestring)
// Creates a dynamic wide string from a PIC G(n) data item.
```

Usage

Common to clients and servers.

Description

The `WSTRSETP` function is exactly the same as `WSTRSET`, except that `WSTRSETP` does copy trailing spaces to the unbounded wide string. Refer to "WSTRSET" on page 528 for more details.

CHECK-STATUS

Synopsis

```
CHECK-STATUS
// Checks to see if a system exception has occurred on an API call.
```

Usage

Common to clients and servers.

Description

The `CHECK-STATUS` paragraph written in COBOL checks to see if a system exception has occurred on an API call. It is not an API in the COBOL runtime. It is contained in the *orbixhlq*.`INCLUDE.COPYLIB(CHKERRS)` member. To use `CHECK-STATUS`, you must use `ORBSTAT` to register the `ORBIX-STATUS-INFORMATION` block with the COBOL runtime. (Refer to "ORBSTAT" on page 474.) You should call `CHECK-STATUS` from the application on each subsequent API call, to determine if an exception has occurred on that API call.

The `CHECK-STATUS` paragraph checks the `CORBA-EXCEPTION` variable that is defined in the `ORBIX-STATUS-INFORMATION` block, and which is updated after every API call. If an exception has occurred, the following fields are set in the `ORBIX-STATUS-INFORMATION` block:

`CORBA-EXCEPTION`	This contains the appropriate value relating to the exception that has occurred. Values are in the range `1–36`. A `0` value means no exception has occurred.
`COMPLETION-STATUS-`	This can be: `COMPLETION-STATUS-YES`—Value `0`. `COMPLETION-STATUS-NO`—Value `1`. `COMPLETION-STATUS-MAYBE`—Value `2`.
`EXCEPTION-TEXT`	This is a COBOL pointer that contains a reference to the text of the CORBA system exception that has occurred.

Note: When an exception occurs, the `JCL RETURN CODE` is set to `12` and the application terminates.

Parameters

`CHECK-STATUS` takes no parameters.

Definition

The `CHECK-STATUS` function is defined as follows in the `CHKERRS` copybook:

```
****************************************************************
*
* (C) Copyright 1997-2021 Micro Focus or one of its affiliates.
*
* The only warranties for products and services of
* Micro Focus and its affiliates and licensors
* ("Micro Focus") are as may be set forth in the express
* warranty statements accompanying such products and
* services. Nothing herein should be construed as
* constituting an additional warranty. Micro Focus shall not
* be liable for technical or editorial errors or omissions
* contained herein. The information contained herein is
* subject to change without notice.
*
* Except as specifically indicated otherwise, this document
* contains confidential information and a valid license is
* required for possession, use or copying. If this work is
* provided to the U.S. Government, consistent with FAR
* 12.211 and 12.212, Commercial Computer Software, Computer
* Software Documentation, and Technical Data for Commercial
* Items are licensed to the U.S. Government under vendor's
* standard commercial license.
*
****************************************************************
*      Check Errors Section for Batch COBOL.
*
 CHECK-STATUS.
*=============
       IF NOT CORBA-NO-EXCEPTION THEN
       DISPLAY "System Exception encountered"
       DISPLAY "Function called  : " WS-API-CALLED
       SET CORBA-EXCEPTION-INDEX TO CORBA-EXCEPTION
       SET CORBA-EXCEPTION-INDEX UP BY 1
       DISPLAY "Exception name   : "
           CORBA-EXCEPTION-NAME(CORBA-EXCEPTION-INDEX)


       CALL "STRGET" USING EXCEPTION-TEXT
                           ERROR-TEXT-LEN OF
                           ORBIX-EXCEPTION-TEXT
                           ERROR-TEXT OF
```

```
                                ORBIX-EXCEPTION-TEXT

          DISPLAY "Exception        : "
          DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (1:64)
          DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (64:64)
          DISPLAY ERROR-TEXT OF ORBIX-EXCEPTION-TEXT (128:64)
          MOVE 12 TO RETURN-CODE
          STOP RUN
     END-IF.
```

Note: The CHECK-STATUS paragraph in the CERRSMFA copybook is almost exactly the same, except it does not set the RETURN-CODE register, and it calls GOBACK instead of STOP RUN if a system exception occurs. This means that the native version of CHECK-STATUS is used to update the return code and exit the program.

Example

The following is an example of how to use CHECK-STATUS in the batch server implementation program:

```
DO-SIMPLE-SIMPLEOBJECT-CALL-ME.
    CALL "COAGET"  USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
    SET WS-COAGET TO TRUE.
    PERFORM CHECK-STATUS.

    CALL "COAPUT"  USING SIMPLE-SIMPLEOBJECT-70FE-ARGS.
    SET WS-COAPUT TO TRUE.
    PERFORM CHECK-STATUS.

****************************************************************
* Check Errors Copybook
****************************************************************
    COPY CHKERRS.
```

Note: The COPY CHKERRS statement in the preceding example is replaced with COPY CERRSMFA in the IMS or CICS server programs, COPY CHKCLCIC in CICS client programs, and COPY CHKCLIMS in IMS client programs. See Table 6 on page 56 and Table 12 on page 132 for more details of these copybooks.

Deprecated APIs

Deprecated APIs

This section summarizes the APIs that were available with the Orbix 2.3 COBOL adapter, but which are now deprecated with the Orbix COBOL runtime. It also outlines the APIs that are replacing these deprecated APIs.

```
OBJGET(IN object_ref, OUT dest_pointer, IN src_length)
// Orbix 2.3 : Returned a stringified Orbix object reference.
// Orbix Mainframe: No replacement. Supported on the server side
// for migration purposes.

OBJGETI(IN object_ref, OUT dest_pointer, IN dest_length)
// Orbix 2.3 : Returned a stringified interoperable object
//             reference (IOR) from a valid object reference.
// Orbix Mainframe: Replaced by OBJTOSTR.

OBJSET(IN object_name, OUT object_ref)
// Orbix 2.3 : Created an object reference from a stringified
//             object reference.
// Orbix Mainframe: Replaced by STRTOOBJ.

OBJSETM(IN object_name, IN marker, OUT object_ref)
// Orbix 2.3 : Created an object reference from a stringified
//             object reference and set its marker.
// Orbix Mainframe: Replaced by OBJNEW.

ORBALLOC(IN length, OUT pointer)
// Orbix 2.3 : Allocated memory at runtime.
// Orbix Mainframe: Replaced by MEMALLOC.

ORBFREE(IN pointer)
// Orbix 2.3 : Freed memory.
// Orbix Mainframe: Replaced by MEMFREE and STRFREE.

ORBGET(INOUT complete_cobol_operation_parameter_buffer)
// Orbix 2.3 : Got IN and INOUT values.
// Orbix Mainframe: Replaced by COAGET.

ORBINIT(IN server_name, IN server_name_len)
// Orbix 2.3 : Equivalent to impl_is_ready in C++.
// Orbix Mainframe: Replaced by COARUN.

ORBPUT(INOUT complete_cobol_operation_parameter_buffer)
// Orbix 2.3 : Returned INOUT, OUT & result values.
```

```
// Orbix Mainframe: Replaced by COAPUT.

ORBREGO(IN cobol_interface_description, OUT object_ref)
// Orbix 2.3 : Describes an interface to the COBOL adapter and
//             creates an object reference using the interface
//             description.
// Orbix Mainframe: Replaced by OBJNEW and ORBREG.

ORBREQ(IN request_info_buffer)
// Orbix 2.3 : Provided current request information.
// Orbix Mainframe: Replaced by COAREQ.

STRSETSP(OUT dest_pointer, IN src_length, IN src)
// Orbix 2.3 : Created a dynamic string from a PIC X(n) data item.
// Orbix Mainframe: Replaced by STRSETP.
```

Part 3

Appendices

In this part

This part contains the following appendices:

POA Policies

This appendix summarizes the POA policies that are supported by the Orbix COBOL runtime, and the argument used with each policy.

In this appendix

This chapter contains the following sections:

Overview

POA policies play an important role in determining how the POA implements and manages objects and processes client requests. There is only one POA created by the Orbix COBOL runtime, and that POA uses only the policies listed in this chapter.

See the *CORBA Programmer's Guide, C++* for more details about POAs and POA policies in general. See the `PortableServer::POA` interface in the *CORBA Programmer's Reference*, *C++* for more details about the POA interface and its policies.

Note: The POA policies described in this chapter are the only POA policies that the Orbix COBOL runtime supports. Orbix COBOL programmers have no control over these POA policies. They are outlined here simply for the purposes of illustration and the sake of completeness.

POA policy listing

Table 42 describes the POA policies that are supported by the Orbix COBOL runtime, and the argument used with each policy.

Table 42: *POA Policies Supported by COBOL Runtime (Sheet 1 of 3)*

Policy	Argument Used	Description
Id Assignment	USER_ID	This policy determines whether object IDs are generated by the POA or the application. The USER_ID argument specifies that only the application can assign object IDs to objects in this POA. The application must ensure that all user-assigned IDs are unique across all instances of the same POA. USER_ID is usually assigned to a POA that has an object lifespan policy of PERSISTENT (that is, it generates object references whose validity can span multiple instances of a POA or server process, so the application requires explicit control over object IDs).
Id Uniqueness	MULTIPLE_ID	This policy determines whether a servant can be associated with multiple objects in this POA. The MULTIPLE_ID specifies that any servant in the POA can be associated with multiple object IDs.
Implicit Activation	NO_IMPLICIT_ACTIVATION	This policy determines the POA's activation policy. The NO_IMPLICIT_ACTIVATION argument specifies that the POA only supports explicit activation of servants.

Table 42: *POA Policies Supported by COBOL Runtime (Sheet 2 of 3)*

Policy	Argument Used	Description
Lifespan	`PERSISTENT`	This policy determines whether object references outlive the process in which they were created. The `PERSISTENT` argument specifies that the IOR contains the address of the location domain's implementation repository, which maps all servers and their POAs to their current locations. Given a request for a persistent object, the Orbix daemon uses the object's virtual address first, and looks up the actual location of the server process via the implementation repository.
Request Processing	`USE_ACTIVE_OBJECT_MAP_ONLY`	This policy determines how the POA finds servants to implement requests. The `USE_ACTIVE_OBJECT_MAP_ONLY` argument assumes that all object IDs are mapped to a servant in the active object map. The active object map maintains an object-servant mapping until the object is explicitly deactivated via `deactivate_object()`. This policy is typically used for a POA that processes requests for a small number of objects. If the object ID is not found in the active object map, an `OBJECT_NOT_EXIST` exception is raised to the client. This policy requires that the POA has a servant retention policy of `RETAIN`.

Table 42: *POA Policies Supported by COBOL Runtime (Sheet 3 of 3)*

Policy	Argument Used	Description
Servant Retention	`RETAIN`	The `RETAIN` argument with this policy specifies that the POA retains active servants in its active object map.
Thread	`SINGLE_THREAD_MODEL`	The `SINGLE_THREAD_MODEL` argument with this policy specifies that requests for a single-threaded POA are processed sequentially. In a multi-threaded environment, all calls by a single-threaded POA to implementation code (that is, servants and servant managers) are made in a manner that is safe for code that does not account for multi-threading.

System Exceptions

This appendix summarizes the Orbix system exceptions that are specific to the Orbix COBOL runtime.

Note: This appendix does not describe other Orbix system exceptions that are not specific to the COBOL runtime. See the *CORBA Programmer's Guide, C++* for details of these other system exceptions.

In this appendix

This appendix contains the following sections:

CORBA::INITIALIZE:: exceptions

The following exception is defined within the `CORBA::INITIALIZE::` scope:

`UNKNOWN`	This exception is raised by any API when the exact problem cannot be determined.

CORBA::BAD_PARAM:: exceptions

The following exceptions are defined within the CORBA::BAD_PARAM:: scope:

UNKNOWN_OPERATION	This exception is raised by ORBEXEC, if the operation is not valid for the interface.
NO_OBJECT_IDENTIFIER	This exception is raised by OBJNEW, if the parameter for the object name is an invalid string.
INVALID_SERVER_NAME	This exception is raised if the server name that is passed does not match the server name passed to ORBSRVR.

CORBA::INTERNAL:: exceptions

The following exceptions are defined within the CORBA::INTERNAL:: scope:

UNEXPECTED_INVOCATION	This exception is raised on the server side when a request is being processed, if a previous request has not completed successfully.
UNKNOWN_TYPECODE	This exception is raised internally by the COBOL runtime, to show that a serious error has occurred. It normally means that there is an issue with the typecodes in relation to either the *idlmembername*X copybook or the application itself.
INVALID_STREAMABLE	This exception is raised internally by the COBOL runtime, to show that a serious error has occurred. It normally means that there is an issue with the typecodes in relation to either the *idlmembername*X copybook or the application itself.

CORBA::BAD_INV_ORDER:: exceptions

The following exceptions are defined within the CORBA::BAD_INV_ORDER:: scope:

INTERFACE_NOT_REGISTERED	This exception is raised if the specified interface has not been registered via ORBREG.
INTERFACE_ALREADY_REGISTERED	This exception is raised by ORBREG, if the client or server attempts to register the same interface more than once.

`ADAPTER_ALREADY_INITIALIZED`	This exception is raised by `ORBARGS`, if it is called more than once in a client or server.
`STAT_ALREADY_CALLED`	This exception is raised by `ORBSTAT` if it is called more than once.
`SERVER_NAME_ALREADY_SET`	This exception is raised by `ORBSRVR`, if the API is called more than once.
`SERVER_NAME_NOT_SET`	This exception is raised by `OBJNEW`, `COAREQ`, `OBJGETID`, or `COARUN`, if `ORBSRVR` is called.
`NO_CURRENT_REQUEST`	This exception is raised by `COAREQ`, if no request is currently in progress.
`ARGS_NOT_READ`	This exception is raised by `COAPUT`, if the `in` or `inout` parameters for the request have not been processed.
`ARGS_ALREADY_READ`	This exception is raised by `COAGET`, if the `in` or `inout` parameters for the request have already been processed.
`TYPESET_NOT_CALLED`	This exception is raised by `ANYSET` or `TYPEGET`, if the typecode for the `any` type has not been set via a call to `TYPESET`.

CORBA::DATA_CONVERSION:: exceptions

The following exception is defined within the `CORBA::DATA_CONVERSION::` scope:

`VALUE_OUT_OF_RANGE`	This exception is raised by `ORBEXEC`, `COAGET`, or `COAPUT`, if the value is determined to be out of range when marshalling a `long`, `short`, `unsigned short`, `unsigned long long long`, or `unsigned long long` type.

Installed Data Sets

This appendix provides an overview listing of the data sets installed with Orbix Mainframe that are relevant to development and deployment of COBOL applications.

In this appendix

This appendix contains the following sections:

Overview

The list of data sets provided in this appendix is specific to COBOL and intentionally omits any data sets specific to PL/I or C++. For a full list of all installed data sets see the *Mainframe Installation Guide*.

List of COBOL-related data sets

Table 43 lists the installed data sets that are relevant to COBOL.

Table 43: *List of Installed Data Sets Relevant to COBOL (Sheet 1 of 4)*

Data Set	Description
`orbixhlq.ADMIN.GRAMMAR`	Contains `itadmin` grammar files.
`orbixhlq.ADMIN.HELP`	Contains `itadmin` help files.
`orbixhlq.ADMIN.LOADLIB`	Contains Orbix administration programs.
`orbixhlq.CBL.OBJLIB`	Contains programs for Orbix COBOL support.

Table 43: *List of Installed Data Sets Relevant to COBOL (Sheet 2 of 4)*

Data Set	Description
orbixhlq.CONFIG	Contains Orbix configuration information.
orbixhlq.DEMO.ARTIX.BLD.JCLLIB	Contains jobs to build the Artix Transport demonstrations.
orbixhlq.DEMO.CICS.CBL.BD.LOADLIB	PDSE used to store programs for the CICS COBOL demonstrations when using a COBOL compiler later than 4.2
orbixhlq.DEMO.CICS.CBL.BLD.JCLLIB	Contains jobs to build the CICS COBOL demonstrations.
orbixhlq.DEMO.CICS.CBL.COPYLIB	Used to store generated files for the CICS COBOL demonstrations.
orbixhlq.DEMO.CICS.CBL.LOADLIB	Used to store programs for the CICS COBOL demonstrations.
orbixhlq.DEMO.CICS.CBL.README	Contains documentation for the CICS COBOL demonstrations.
orbixhlq.DEMO.CICS.CBL.SRC	Contains program source for the CICS COBOL demonstrations.
orbixhlq.DEMO.CICS.MFAMAP	Used to store CICS server adapter mapping member information for demonstrations.
orbixhlq.DEMO.CBL.BD.LOADLIB	PDSE used to store programs for the COBOL demonstrations when using a COBOL compiler later than version 4.2
orbixhlq.DEMO.CBL.BLD.JCLLIB	Contains jobs to build the COBOL demonstrations.
orbixhlq.DEMO.CBL.COPYLIB	Used to store generated files for the COBOL demonstrations.
orbixhlq.DEMO.CBL.FNBINIT	Used to store initialized records for the FNB demo VSAM files.
orbixhlq.DEMO.CBL.LOADLIB	Used to store programs for the COBOL demonstrations.

Table 43: *List of Installed Data Sets Relevant to COBOL (Sheet 3 of 4)*

Data Set	Description
orbixhlq.DEMO.CBL.MAP	Used to store name substitution maps for the COBOL demonstrations.
orbixhlq.DEMO.CBL.README	Contains documentation for the COBOL demonstrations.
orbixhlq.DEMO.CBL.RUN.JCLLIB	Contains jobs to run the COBOL demonstrations.
orbixhlq.DEMO.CBL.SRC	Contains program source for the COBOL demonstrations.
orbixhlq.DEMO.IDL	Contains IDL for demonstrations.
orbixhlq.DEMO.IMS.CBL.BD.LOADLIB	PDSE used to store programs for the IMS COBOL demonstrations when using a COBOL compiler later than version 4.2.
orbixhlq.DEMO.IMS.CBL.BLD.JCLLIB	Contains jobs to build the IMS COBOL demonstrations.
orbixhlq.DEMO.IMS.CBL.COPYLIB	Used to store generated files for the IMS COBOL demonstrations.
orbixhlq.DEMO.IMS.CBL.LOADLIB	Used to store programs for the IMS COBOL demonstrations.
orbixhlq.DEMO.IMS.CBL.README	Contains documentation for the IMS COBOL demonstrations.
orbixhlq.DEMO.IMS.CBL.SRC	Contains program source for the IMS COBOL demonstrations.
orbixhlq.DEMO.IMS.MFAMAP	Used to store IMS server adapter mapping member information for demonstrations.
orbixhlq.DEMO.IORS	Used to store IORs for demonstrations.
orbixhlq.DEMO.TYPEINFO	Optional type information store.
orbixhlq.DOMAINS	Contains Orbix configuration information.
orbixhlq.INCLUDE.COPYLIB	Contains include file for COBOL programs.

Table 43: *List of Installed Data Sets Relevant to COBOL (Sheet 4 of 4)*

Data Set	Description
orbixhlq.INCLUDE.IT@CICS.IDL	Contains IDL files.
orbixhlq.INCLUDE.IT@IMS.IDL	Contains IDL files.
orbixhlq.INCLUDE.IT@MFA.IDL	Contains IDL files.
orbixhlq.INCLUDE.OMG.IDL	Contains IDL files.
orbixhlq.INCLUDE.ORBIX.IDL	Contains IDL files.
orbixhlq.INCLUDE.ORBIX@XT.IDL	Contains IDL files.
orbixhlq.JCLLIB	Contains jobs to run Orbix.
orbixhlq.LKED	Contains side-decks for the DLLs.
orbixhlq.LOADLIB	Contains binaries & DLLs.
orbixhlq.LPALIB	Contains LPA eligible programs.
orbixhlq.MFA.LOADLIB	Contains DLLS required for deployment of Orbix programs in IMS.
orbixhlq.PROCLIB	Contains JCL procedures.

COBOL Literal Delimiters

This appendix provides a list of the files that will need to be changed if you want to use single quotes rather than double quotes for COBOL literals.

Note: If you want to use single quotes, you must specify the -Qs option with the Orbix IDL compiler. See "-Q Argument" on page 347 for more details.

In this appendix

This appendix contains the following sections:

Overview

The COBOL compiler can be configured to use either double quotes or single quotes. If your current JCL uses the `APOST` compiler option, you are using single quotes or an apostrophe to denote literals. If your current JCL uses the `QUOTE` compiler option, you are using double quotes. By default, Orbix expects the `QUOTE` compiler option to be in effect. All JCL procedures and demonstration code supplied with Orbix Mainframe uses double quotes. If you need to use single quotes, you must manually convert several files, by editing them and changing the double quotes to single quotes.

List of files

The files you need to change depend on which components of Orbix you are using. For example, if you do not use CICS, you do not need to change those files. The following is a guideline to help you determine which files you need to change:

1. You need to convert the following copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS, because they are used in all cases:
   - CORBA
   - CORBATYP

- If you are testing in batch, you need to convert the following copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS:
  - CHKERRS
  - CHKFILE
  - IORFD
  - IORSLCT
  - PROCPARM
- If you are using IMS, you need to convert the following IMS-specific copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS:
  - CERRSMFA
  - CHKCLIMS
  - GETUNIQE
  - IMSWRITE
  - UPDTPCBS
- If you are using CICS, you need to convert the following CICS-specific copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS:
  - CERRSMFA
  - CHKCICS
  - CHKCLCIC
  - CICWRITE
  - CICWRT
- If you are using Web services in IMS, you need to convert the following IMS-specific copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS:
  - WSIMSCL
  - WSIMSPCB
  - WSURLSTR

- If you are using Web services in CICS, you need to convert the following CICS-specific copybooks in the *orbixhlq*.INCLUDE.COPYLIB PDS:
    - WSCICSCL
    - WSCICSSV
    - WSURLSTR
- If you are using the Orbix JCL procedures to compile your programs, you need to update the compile option in the following files in the *orbixhlq*.PROCLIB PDS:

ORXCBCCC[a]	CICS COBOL clients
ORXCBCSC[a]	CICS COBOL servers
ORXCBLCC	Batch and IMS Orbix COBOL client
ORXCBLSC	Batch and IMS Orbix COBOL servers

a. For CICS compiles, ensure that you update the CICSXLTC variable to use APOST, so that the CICS translator will use single quotes.

- If you want to run the batch nested sequence demonstration, you need to update the following files in *orbixhlq*.DEMO.CBL.COPYLIB PDS:
    - BOUNDS
    - INDATA
    - UBOUNDS
- If you want to run the IMS nested sequence demonstration, you need to update the following files in *orbixhlq*.DEMO.IMS.CBL.COPYLIB PDS:
    - BOUNDS
    - INDATA
    - UBOUNDS
- If you want to run the CICS nested sequence demonstration, you need to update the following files in *orbixhlq*.DEMO.CICS.CBL.COPYLIB PDS:
    - BOUNDS
    - INDATA
    - UBOUNDS

- Depending on the demonstrations you want to run, all relevant members in the `*orbixhlq*.DEMO.CBL.SRC`, `*orbixhlq*.DEMO.IMS.CBL.SRC`, or `*orbixhlq*.DEMO.CICS.CBL.SRC` PDS need to be updated. Refer to the README files in `*orbixhlq*.CBL.README`, `*orbixhlq*.IMS.CBL.README`, or `*orbixhlq*.CICS.CBL.README` for details of specific source files.

ORXCOPY Utility

This appendix provides details of the ORXCOPY utility which allows you to copy data between different types of files, such as on-host data sets and UNIX-based HFS files.

In this appendix

This appendix contains the following sections:

Synopsis

```
orxcopy in-file out-file
```

Description

The `ORXCOPY` utility is used to transfer data between different types of MVS files, in particular between record-oriented data sets and stream-oriented UNIX files.

Multiple records are treated as a single line if they contain a backslash (that is, "`\`") in the continuation column. The continuation column is the last column in a variable-length record (VB) or the ninth-to-last column in a fixed-length record (FB). The final eight columns in an FB data set are reserved for sequence numbers and are ignored.

The `ORXCOPY` utility allows data to be transferred back and forth with little or no loss of information. When HFS files with long lines are copied into FB or VB data sets with shorter record lengths, the lines are wrapped across multiple records using the continuation column. When files are copied between data sets of different record lengths, lines are "unwrapped" and "re-wrapped" as necessary.

Most kinds of files used in Orbix (for example, license files, IDL files, configuration files, and C++ files) are equivalent in both "wrapped" and "unwrapped" form.

Operands

The *`in-file`* and *`out-file`* qualifiers for `ORXCOPY` represent the names of MVS files or data sets. The following rules apply:

- Names beginning with "`DD:`" or "`//DD:`" are assumed to refer to an allocated DD statement.
- Other names beginning with "`//`" and not containing additional "`/`" characters are assumed to be data sets.
- Single quotes indicate a dataset name (however, `ORXCOPY` does not attempt to infer a "prefix" qualifier such as the user name).
- Names that might refer to either an MVS data set or an HFS file should be specified unambiguously with an appropriate prefix. For example:

`//README.TXT`	Data set
`./README.TXT`	HFS file

UNIX examples

The following command copies a domain configuration from a PDS member to a UNIX file:

```
orxcopy "//HLQ.ORBIX63.DOMAINS(FILEDOMA)" filedomain.cfg
```

The following command copies a C++ source file into a PDS:

```
orxcopy objectImpl.h "//HLQ.PROJECT.H(IMPL)"
```

The following command reads an IOR stored in a PDS:

```
orxcopy "//HLQ.ORBIX63.DEMO.IORS(EXTENDED)" extend.ior
```

JCL example

The following piece of JCL copies a license file from a VB data set to an FB PDS:

```
//GO  EXEC PROC=ORXG,PGM=ORXCOPY,
//     PPARM="DD:IN DD:OUT(LICENSES)"
//IN  DD DISP=SHR,DSN=MY.FTPED.LICENSE.FILE
//OUT DD DISP=SHR,DSN=HLQ.ORBIX63.CONFIG
```

Restriction

The `ORXCOPY` utility does not support a file specification of `"DD:`*`NAME`*`"` where *`NAME`* represents a DD card that uses the `"PATH="` keyword. You must specify the pathname directly to `ORXCOPY` instead.

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