Migrating from Orbix 3.3 to 6.3

V6.3.14

Table of Contents

Preface

This document explains how to migrate applications from the Orbix 3 and OrbixWeb products, which conform to CORBA 2.1, to Orbix 6.3, which conforms to CORBA 2.6.

Audience

This document is aimed at *C++ or Java programmers* who are already familiar with Orbix or OrbixWeb products and who now want to migrate all or part of a system to use Orbix 6.3.

Parts of this document are relevant also to *administrators* familiar with Orbix and OrbixWeb administration. See Administration and Configuring for Interoperability.

Typographical conventions

This guide uses the following typographical conventions:

| | | | ---------- | ----------a---------- | | `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.<br/><br/> |
```

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 or Windows 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.

Introduction

The newest generation of Orbix provides significant advances over the previous generation of products.

Advantages of Orbix 6.3

The recommended path for customers upgrading to a new version of Orbix is to move to Orbix 6.3. The extra features offered by Orbix can be divided into the following categories:

- CORBA 2.6-compliant features.
- Unique features.

CORBA 2.6-compliant features

Because Orbix 6.3 contains a CORBA 2.6-compliant ORB, it offers the following advantages over Orbix 2.x (all minor versions of Orbix 2) and Orbix 3.x (all minor versions of Orbix 3):

- Portable interceptor support.
- Codeset negotiation support.
- Value type support.
- Asynchronous method invocation (AMI) support.
- Persistent State Service (PSS) support.
- Dynamic any support.

Unique features

Orbix 6.3 also offers some unique benefits over other commercial ORB implementations, including:

- ORB extensibility using Adaptive Runtime Technology (ART).

  Orbix 6.3 has a modular structure built on a micro-kernel architecture. Required ORB modules, ORB plug-ins, are specified in a configuration file and loaded at runtime, as the application starts up. The advantage of this approach is that new ORB functionality can be dynamically loaded into an Orbix application without rebuilding the application.
- Improved performance.

The performance of Orbix 6.3 has been optimized, resulting in performance that is faster than Orbix 3.x and OrbixWeb 3.x in every respect.

- Advanced deployment and configuration.

  Orbix 6.3 supports a flexible model for the deployment of distributed applications. Applications can be grouped into configuration domains and organized either as file-based configuration domains or as configuration repository-based configuration domains.

- Rapid application development using the Orbix code generation toolkit.

  The code generation toolkit is an extension to the IDL compiler that generates a working application prototype—based on your application IDL—in a matter of seconds.

Migration Resources

Overview of resources

Rocket Software is committed to assisting you with your migration effort, to ensure that it proceeds as easily and rapidly as possible. The following resources are currently available:

- This migration and interoperability guide.

  This technical document provides detailed guidance on converting source code to Orbix 6.3. The document aims to provide comprehensive coverage of migration issues, and to demonstrate how features supported in earlier Orbix versions can be mapped to Application Server Platform features.

- Rocket Software Orbix 6.x Upgrade Assessment.

  For customers on Orbix 2000, Orbix E2A ASP or versions of Orbix predating Orbix 3.3 one may consider the Orbix 6.x Upgrade Assessment, ensuring the application of best practices and access to the latest updated functionality: https://www.microfocus.com/en-us/support/consulting-professional-services-orbix-6-x

Migration Options

The basic alternatives for migrating a distributed application to Orbix are to migrate the whole application at once, or to perform the migration gradually, replacing parts of the application piece by piece. For the latter option (gradual migration), you will end up with a mixed deployment consisting of Orbix and older Orbix products.

Migrating to Orbix 6.3

The CORBA 2.6 specification, on which the Orbix 6.3 ORB is based, standardizes almost every aspect of CORBA programming. Migrating your source code to Application Server Platform, therefore, represents a valuable investment because your code will be based on a stable, highly standardized programming interface.

Client side

On the client side, the main issue for migration is that the Orbix `_bind()` function is not supported in Orbix 6.3. The CORBA Naming Service is now the recommended mechanism for establishing contact with CORBA servers.

Server side

On the server side, the basic object adapter (BOA) must be replaced by the portable object adapter (POA). This is one of the major differences between the CORBA 2.1 and the CORBA 2.6 specifications. The POA is much more tightly specified than the old BOA; hence server code based on the POA is well standardized.

Proprietary features

Orbix 3.x and OrbixWeb 3.x support a range of proprietary features not covered by the CORBA standard —for example, the Orbix locator, filters, loaders, smart proxies, transformers and I/O callbacks. When migrating to Orbix 6.3, the proprietary features must be replaced by standard CORBA 2.6 features. This migration guide details how each of the proprietary features can be replaced by equivalent Orbix 6.3 functionality.

Further details

The details of migrating to Orbix 6.3 are discussed in Part II of this guide. See Migrating to Orbix 6.3.

Mixed Deployment

Mixed Deployment is appropriate when a number of CORBA applications are in deployment simultaneously. Some applications might be upgraded to use Orbix 6.3 whilst others continue to use Orbix 3.x and OrbixWeb 3.x. This kind of mixed environment requires on-the-wire compatibility between the generation 3 products and Orbix 6.3. Extensive testing has been done to ensure interoperability with Orbix 6.3.

On-the-wire interoperability

Both Orbix 3.3 and Orbix 6.3 have been modified to achieve an optimum level of on-the-wire compatibility between the two products.

Further details

Interoperability is discussed in Interoperability.

Migrating to Orbix 6.3

IDL Migration

This section discusses the Orbix 3.x IDL features that are not available in Orbix 6.3.

The context Clause

IDL Syntax

According to IDL grammar, a `context` clause can be added to an operation declaration, to specify extra variables that are sent with the operation invocation. For example, the following `Account::deposit()` operation has a `context` clause:

```
//IDL
interface Account {
void deposit(in CashAmount amount)
context("sys_time", "sys_location");
//...
};
```

Migrating to Orbix 6

The `context` clause is not supported by Orbix 6. IDL contexts are generally regarded as type-unsafe. Orbix clients that use them need to be migrated, to transmit their context information using another mechanism, such as service contexts, or perhaps as normal IDL parameters.

The opaque Type

Migrating to Orbix 6.3

The object-by-value (OBV) specification, introduced in CORBA 2.3 and supported in Orbix 6.3, replaces opaques.

The Principal Type

Principal IDL type

The CORBA specification deprecates the `Principal` IDL type; therefore the `Principal` IDL type is not supported by Orbix 6.3.

Interoperability

Orbix 6.3 has some limited on-the-wire support for the `Principal` type, to support interoperability with Orbix 3.x applications.

See Launch and Invoke Rights.

Client Migration

Migration of client code from Orbix 3 to Orbix 6.3 is generally straightforward, because relatively few changes have been made to the client-side API.

Replacing the _bind() Function

The `_bind()` function is not supported in Orbix 6.3. All calls to `_bind()` must be replaced by one of the following:

- CORBA Naming Service.
- CORBA Trader Service.
- Object-to-string conversion.
- corbaloc URL.
- ORB::resolve_initial_references().

CORBA Naming Service

The naming service is the recommended replacement for `_bind()` in most applications. Migration to the naming service is straightforward on the client side. The triplet of `markerName`, `serverName`, and `hostName`, used by the `_bind()` function to locate an object, is replaced by a simple name in the naming service.

When using the naming service, an object's name is an abstraction of the object location and the actual location details are stored in the naming service. Object names are resolved using these steps:

1. An initial reference to the naming service is obtained by calling `resolve_initial_references()` with `NameService` as its argument.
2. The client uses the naming service reference to resolve the names of CORBA objects, receiving object references in return.

Orbix 6.3 supports the CORBA Interoperable Naming Service, which is backward-compatible with the old CORBA Naming Service and adds support for stringified names.

CORBA Trader Service

The Orbix 6.3 trader service provides advanced capabilities for object location and discovery. Unlike the Orbix Naming Service where an object is located by name, an object in the Trading Service does not have a name. Rather, a server advertises an object in the Trading Service based on the kind of service provided by the object. A client locates objects of interest by asking the Trading Service to find all objects that provide a particular service. The client can further restrict the search to select only those objects with particular characteristics.

Object-to-string conversion

CORBA offers two CORBA-compliant conversion functions:

```
CORBA::ORB::object_to_string()
CORBA::ORB::string_to_object()
```

These functions allow you to convert an object reference to and from the stringified interoperable object reference (stringified IOR) format. These functions enable a CORBA object to be located as follows:

1. A server generates a stringified IOR by calling `CORBA::ORB::object_to_string()`.
2. The server passes the stringified IOR to the client (for example, by writing the string to a file).
3. The client reads the stringified IOR from the file and converts it back to an object reference, using `CORBA::ORB::string_to_object()`.

Because they are not scalable, these functions are generally not useful in a large-scale CORBA system. Use them only to build initial prototypes or proof-of-concept applications.

corbaloc URL

A *corbaloc URL* is a form of human-readable stringified object reference. If you are migrating your clients to Orbix 6.3 but leaving your servers as Orbix 3.3 applications, the corbaloc URL offers a convenient replacement for `_bind()`.

To access an object in an Orbix 3.3 server from an Orbix 6.3 client using a corbaloc URL, perform the following steps:

1. Obtain the object key, *ObjectKey*, for the object in question, as follows:

   Get the Orbix 3.3 server to print out the stringified IOR using, for example, the `CORBA::ORB::object_to_string()` operation. The result is a string of the form `IOR:00...`

Use the Orbix 6.3 `iordump` utility to parse the stringified IOR. Copy the string that represents the object key field, *ObjectKey*.

2. Construct a corbaloc URL of the following form:

```
corbaloc:iiop:1.0@*DaemonHost*:*DaemonPort*/*ObjectKey*%00
```

Where *DaemonHost* and *DaemonPort* are the Orbix daemon's host and port respectively. A null character, `%00`, is appended to the end of the *ObjectKey* string because Orbix 3.3 applications expect object key strings to be terminated by a null character.

3. In the source code of the Orbix3 client, use the `CORBA::ORB::string_to_object()` operation to convert the corbaloc URL to an object reference.

The general form of a corbaloc URL for this case is as follows:

```
corbaloc:iiop:*GIOPVersion*@*Host*:*Port*/*Orbix3ObjectKey*%00
```

Where the components of the corbaloc URL are:

- *GIOPVersion*—The maximum GIOP version acceptable to the server. Can be either `1.0` or `1.1`.
- *Host* and *Port*—The daemon's (or server's) host and port. The *Host* can either be a DNS host name or an IP address in dotted decimal format.

The *Orbix3ObjectKey* has the following general form:

```
:\*Host*:*SvrName*:*Marker*::*IFRSvrName*:*InterfaceName*%00
```

Where the components of the Orbix 3 object key are:

- *Host*—The server host. The *Host* can either be a DNS host name or an IP address in dotted decimal format.
- *SvrName*—The server name of the Orbix 3.3 server.
- *Marker*—The CORBA object's marker.
- *IFRSvrName*—Can be either `IR` or `IFR`.
- *InterfaceName*—The object's IDL interface name.

> **Warning**
>
> Constructing an Orbix 3.3 object key directly based on the preceding format does *not* always work because some versions of Orbix impose extra restrictions on the object key format. Extracting the object key from the server-generated IOR is a more reliable approach.

If you encounter any difficulties with using corbaloc URLs, please contact https://www.microfocus.com/en-us/support/.

ORB::resolve_initial_references()

The `CORBA::ORB::resolve_initial_references()` operation provides a mechanism for obtaining references to basic CORBA objects (for example, the naming service, the interface repository, and so on).

Orbix 6.3 allows the `resolve_initial_references()` mechanism to be extended. For example, to access the `BankApplication` service using `resolve_initial_references()`, simply add the following variable to the Orbix 6.3 configuration:

```
# Orbix 6.3 Configuration File
initial_references:BankApplication:reference = "IOR:010347923849..."
```

Use this mechanism sparingly. The OMG defines the intended behavior of `resolve_initial_references()` and the arguments that can be passed to it. A name that you choose now might later be reserved by the OMG. It is generally better to use the naming service to obtain initial object references for application-level objects.

Callback Objects

POA policies for callback objects

Callback objects must live in a POA, like any other CORBA object; hence, there are certain similarities between a server and a client with callbacks. The most sensible POA policies for a POA that manages callback objects are shown in Table 1.

Table 1 POA Policies for Callback Objects

Policy Type	Policy Value
Lifespan	`TRANSIENT1`
ID Assignment	`SYSTEM_ID`
Servant Retention	`RETAIN`
Request Processing	`USE_ACTIVE_OBJECT_MAP_ONLY`

These policies allow for easy management of callback objects and an easy upgrade path. Callback objects offer one of the few cases where the root POA has reasonable policies, provided the client is multi-threaded (as it normally is for callbacks).

1 a.By choosing a `TRANSIENT` lifespan policy, you remove the need to register the client with an Orbix 6.3 locator daemon.

IDL-to-C++ Mapping

The definition of the IDL-to-C++ mapping has changed little going from Orbix 3.x to Orbix 6.3 (apart from some extensions to support valuetypes). Two notable changes are:

- The CORBA::Any Type.
- The CORBA::Environment Parameter.

The CORBA::Any Type

In Orbix 6.3, it is not necessary to use the type-unsafe interface to `Any`. Recent revisions to the CORBA specification have filled the gaps in the IDL-to-C++ mapping that made these functions necessary. That is, the following functions are deprecated in Orbix 6.3:

```
// C++
// CORBA::Any Constructor.
Any(
CORBA::TypeCode_ptr tc,
void* value,
CORBA::Boolean release = 0
);
// CORBA::Any::replace() function.
void replace(
CORBA::TypeCode_ptr,
void* value,
CORBA::Boolean release = 0
);
```

The CORBA::Environment Parameter

The signatures of IDL calls no longer contain the `CORBA::Environment` parameter. This parameter was needed for languages that did not support native exception handling. However, Orbix applications also use it for operation timeouts.

System Exception Semantics

Orbix and OrbixWeb clients that catch specific system exceptions might need to change the exceptions they handle when they are migrated to Orbix.

System exceptions

Orbix 6.3 follows the latest CORBA standards for exception semantics. Table 2 shows the two system exceptions most likely to affect existing code.

Table 2 Migrated System Exceptions

When This Happens	Orbix 3 and OrbixWeb Raise	Orbix 6.3 Raises
Server object does not exist	`INV_OBJREF`	`OBJECT_NOT_EXIST`

When This Happens	Orbix 3 and OrbixWeb Raise	Orbix 6.3 Raises
Cannot connect to server	`COMM_FAILURE`	`TRANSIENT`

Minor codes

System exception minor codes are completely different between OrbixWeb 3.2 and Orbix 6.3 for Java. Applications that examine minor codes need to be modified to use Orbix 6.3 for Java minor codes.

Dynamic Invocation Interface

Proprietary dynamic invocation interface

Orbix-proprietary dynamic invocation interface (DII) functions are not available in Orbix 6.3. Code that uses `CORBA::Request::operator<<()` operators and overloads must be changed to use CORBA-compliant DII functions.

> **Note**
>
> Orbix 6.3-generated stub code consists of sets of statically generated CORBA-compliant DII calls.

Server Migration

Server code typically requires many more changes than client code. The main issue for server code migration is the changeover from the basic object adapter (BOA) to the portable object adapter (POA).

Function Signatures

Changes to the signature

In Orbix 6.3, two significant changes have been made to C++ function signatures:

- The `CORBA::Environment` parameter has been dropped.
- New types are used for `out` parameters. An `out` parameter of `T` type is now passed as a `T_out` type.

  Consequently, when migrating C++ implementation classes you must replace the function signatures that represent IDL operations and attributes.

Object IDs versus Markers

C++ conversion functions

Orbix 6.3 uses a sequence of octets to compose an object's ID, while Orbix 3 uses string markers. CORBA provides the following helper methods to convert between the two types; hence migration from marker dependencies to Object IDs is straightforward.

```
// C++
// Converting string marker -----> ObjectId
PortableServer::ObjectId *
PortableServer::string_to_ObjectId(const char *);
// Converting ObjectId -----> string marker
char *
PortableServer::ObjectId_to_string(
const PortableServer::ObjectId&
);
```

Java conversion functions

In Java, an object ID is represented as a byte array, `byte[]`. Hence the following native Java methods can be used to convert between string and object ID formats:

```
// Java
// Converting string marker -----> ObjectId
byte[]
java.lang.String.getBytes();
// Converting ObjectId -----> string marker
// String constructor method:
java.lang.String.String(byte[]);
```

CORBA Objects versus Servant Objects

Orbix 3

In Orbix 3 there is no need to distinguish between a CORBA object and a servant object. When you create an instance of an implementation class in Orbix 3, the instance already has a unique identity (represented by a marker) and therefore represents a unique CORBA object.

Orbix 6.3

In Orbix 6.3, a distinction is made between the identity of a CORBA object (its object ID) and its implementation (a servant). When you create an instance of an implementation class in Orbix 6.3, the instance is a servant object, which has no identity. The identity of the CORBA object (represented by an object ID) must be grafted on to the servant at a later stage, in one of the following ways:

- The servant becomes associated with a unique identity. This makes it a CORBA object, in a similar sense to an object in a BOA-based implementation.
- The servant becomes associated with multiple identities. This case has no parallel in a BOA-based implementation.

  The mapping between object IDs and servant objects is controlled by the POA and governed by POA policies.

BOA to POA Migration

It is relatively easy to migrate a BOA-based server by putting all objects in a simple POA that uses an active object map; however, this approach is unable to exploit most of the functionality that a POA-based server offers. It is worth while redesigning and rewriting servers so they benefit fully from the POA.

Creating an Object Adapter

Creating a BOA in Orbix 3.x

In Orbix 3, a single BOA instance is used. All CORBA objects in a server are implicitly associated with this single BOA instance.

Creating a POA in Orbix 6.3

In Orbix 6.3, an application can create multiple POA instances (using the `PortableServer::POA::create_POA()` operation in C++ and the `org.omg.PortableServer.create_POA()` operation in Java). Each POA instance can be individually configured, using POA policies, to manage CORBA objects in different ways. When migrating to Orbix 6.3, you should give careful consideration to the choice of POA policies, to obtain the maximum benefit from the POA's flexibility.

Defining an Implementation Class

There are two approaches to defining an implementation class in CORBA:

- The inheritance approach.
- The tie approach.

The inheritance approach

The most common approach to implementing an IDL interface in Orbix is to use the inheritance approach. Consider the following IDL fragment:

```
//IDL
module BankSimple {
Account {
//...
};
};
```

The `BankSimple::Account` IDL interface can be implemented by defining a class that inherits from a standard base class. The name of this standard base class for Orbix 3 and Orbix 6.3 is shown in Table 3.

Table 3 Standard Base Classes for the Inheritance Approach

Application Type	Implementation Base Class Name
Orbix 3, C++ (BOA)	`BankSimple::AccountBOAImpl`
Orbix 6.3, C++ (POA)	`POA_BankSimple::Account`
Orbix 3, Java (BOA)	`BankSimple._AccountImplBase`
Orbix 6.3, Java (POA)	`BankSimple.AccountPOA`

Consider a legacy Orbix 3 application that implements `BankSimple::Account` in C++ as the `BankSimple_Account_i` class. The `BankSimple_Account_i` class might be declared as follows:

```
// C++
// Orbix 3 Version
// Inheritance Approach
class BankSimple_Account_i : BankSimple::AccountBOAImpl {
public:
// Declare IDL operation and attribute functions...
};
```

When this implementation class is migrated to Orbix 6.3, the `BankSimple::AccountBOAImpl` base class is replaced by the `POA_BankSimple::Account` base class, as follows:

```
// C++
// Orbix 6.3 Version
// Inheritance Approach
class BankSimple_Account_i : POA_BankSimple::Account {
public:
// Declare IDL operation and attribute functions...
};
```

The tie approach

The tie approach is an alternative mechanism for implementing IDL interfaces. It allows you to associate an implementation class with an IDL interface using a delegation approach rather than an inheritance approach.

In Application Server Platform (C++) the tie classes are generated using C++ templates. When migrating from Orbix 3 to Orbix 6.3, all `DEF_TIE` and `TIE` preprocessor macros must be replaced by the equivalent template syntax.

In Orbix 6.3 (Java) the tie approach is essentially the same as in Orbix 3. However, the names of the relevant Java classes and interfaces are different. For example, given an IDL interface, `Foo`, an Orbix 6.3 servant class implements the `FooOperations` Java interface and the associated Java tie class is called `FooPOATie`.

Creating and Activating a CORBA Object

To make a CORBA object available to clients, you should:

1. Create an implementation object. An implementation object is an instance of the class that implements the operations and attributes of an IDL interface. In Orbix 3, an implementation object is the same thing as a CORBA object. In Orbix3, an implementation object is a servant object, which is not the same thing as a CORBA object.
2. Activate the servant object. Activating a servant object attaches an identity to the object (a marker in Orbix 3 or an object ID in Orbix3) and associates the object with a particular object adapter.

Orbix 3

In Orbix 3, creating and activating an object are rolled into a single step. For example, in C++ you might instantiate a `BankSimple::Account` CORBA object using the following code:

```
// C++
// Orbix 3
// Create and activate a new 'Account' object.
BankSimple_Account_i * acc1 =
new BankSimple_Account_i("*ObjectID*");
```

This step creates the CORBA object and attaches the *ObjectID* identity to it (initializing the object's marker). The constructor automatically activates the CORBA object.

Orbix 6.3

In Orbix 6.3, creating and activating an object are performed as separate steps. For example, in C++ you might instantiate a `BankSimple::Account` CORBA object using the following code:

```
// C++
// Orbix 6.3
// Step 1: Create a new 'Account' object.
BankSimple_Account_i * acc1 = new BankSimple_Account_i();
// Step 2: Activate the new 'Account' object.
PortableServer::ObjectId_var oid =
                  PortableServer::string_to_ObjectId("*ObjectID*");
// persistent_poa created previously
persistent_poa->activate_object_with_id(oid, acc1);
```

Activation is performed as an explicit step in Orbix 6.3. The call to `PortableServer::POA::activate_object_with_id()` attaches the *ObjectID* identity to the object and associates the `persistent_poa` object adapter with the object.

Migrating Proprietary Orbix 3 Features

Proprietary Orbix 3 feature are replaced by a range of standards-compliant Orbix 6.3 features.

Orbix 3 Locator

The Orbix 3 locator is an Orbix-specific feature that is used in combination with `_bind()` to locate server processes. Because Orbix 6.3 does not support `_bind()`, it cannot use the Orbix 3 style locator.

> **Note**
>
> Orbix 6.3 has a feature called a locator, which is not related in any way to the Orbix 3 locator. The Orbix 6.3 locator is a daemon process, `itlocator`, that locates server processes for clients.

If your legacy code uses the Orbix 3 locator, you must replace it with one of the following Orbix 6.3 features:

- High availability.
- The CORBA Naming Service.
- The CORBA Initialization Service.

High availability

The Orbix 6.3's high availability feature provides fault tolerance—that is, a mechanism that avoids having a single point of failure in a distributed application. With the enterprise edition of Orbix 6.3, you can protect your system from single points of failure through clustered servers.

A clustered server comprises multiple instances, or replicas, of the same server; together, these act as a single logical server. Clients invoke requests on the clustered server and Orbix routes the requests to one of the replicas. The actual routing to any replica is transparent to the client.

The CORBA Naming Service

If your legacy code uses the load-balancing feature of the Orbix 3 locator, you can replace this by the `ObjectGroup` feature of the Orbix 6.3's naming service. Object groups are an Orbix-specific extension to the naming service that allow you to register a number of servers under a single name.

Table 4 shows how the Orbix 3 locator maps to the equivalent naming service functionality.

Table 4 Replacing the Orbix 3 Locator by the Naming Service

Orbix 3-Locator	Orbix 6.3-Naming Service
Entry in the locator file, mapping the server name, `SrvName`, to a single server host, `Host Name:` `SrvName:HostName:`	Object binding in the naming service, mapping a `name` to a single object reference.
Entry in the locator file, mapping the server name, `SrvName`, to multiple host names: `SrvName:Host1`, `Host2`, `Host3:`	Object group in the naming service, mapping a name to multiple object references.
Overriding functionality of `CORBA::LocatorClass`.	Custom implementation of the `IT_LoadBalancing::ObjectGroup` interface.

The naming service is the preferred way to locate objects in Orbix 6.3. It is a standard service and is highly scalable.

The CORBA Initialization Service

The initialization service uses the `CORBA::ORB::resolve_initial_references()` operation to retrieve an object reference from an Orbix 6.3 configuration file, `DomainName.cfg`.

Table 5 shows how the Orbix 3 locator maps to the equivalent initialization service functionality.

Table 5 Replacing the Orbix 3 Locator by the Initialization Service

Orbix 3-Locator	Orbix 6.3-Initialization Service
Entry in the locator file, mapping the server name, `SrvName`, to a single server host, `HostName`: `SrvName:HostName:`	Entry in the `DomainName.cfg` file, mapping an `ObjectId` to a single object reference: `initial_references:ObjectId: reference = "IOR:00...";`
Entry in the locator file, mapping the server name, `SrvName`, to multiple host names: `SrvName:Host1,Host2,Host3:`	*No Equivalent*
Override functionality of `CORBA::LocatorClass`.	*No Equivalent*

The initialization service can only be used as a replacement for the Orbix 3 locator when a simple object lookup is needed.

Filters

Filters are a proprietary Orbix 3 mechanism that allow you to intercept invocation requests on the server and the client side.

Orbix 6.3 does not support the filter mechanism. Instead, a variety of Orbix 6.3 features replace Orbix 3 filter functionality.

Equivalents

Table 6 summarizes the typical uses of Orbix 3 filters alongside the equivalent features supported by Orbix 6.3.

Table 6 Orbix 6.3 Alternatives to Filter Features

Orbix 3 Filter Feature	Orbix 6.3 Equivalent
Request logging	Use portable interceptors.

Orbix 3 Filter Feature	Orbix 6.3 Equivalent
Piggybacking data on a Request	Use portable interceptors.
Multi-threaded request processing	Use a multi-threaded POA and (optionally) a proprietary `WorkQueue` POA policy.
Accessing the client's TCP/IP details	*Not supported*.
Security using an authentication filter	Full security support is provided in the Orbix 6.3 enterprise edition.

Request Logging

Using portable interceptors

In Orbix 6.3, request logging is supported by the new portable interceptor feature. Interceptors allow you to access a CORBA request at any stage of the marshaling process, offering greater flexibility than Orbix filters. You can use them to add and examine service contexts. You can also use them to examine the request arguments.

Piggybacking Data on a Request

Piggybacking in Orbix 3

In Orbix 3, filters support a piggybacking feature that enables you to add and remove extra arguments to a request message.

Piggybacking in Orbix 6.3

In Orbix 6.3, piggybacking is replaced by the CORBA-compliant approach using *service contexts*. A service context is an optional block of data that can be appended to a request message, as specified in the IIOP 1.1 standard. The content of a service context can be arbitrary and multiple service contexts can be added to a request.

Multi-Threaded Request Processing

Orbix 3

In Orbix 3, concurrent request processing is supported using an Orbix thread filter. The mechanism is flexible because it gives the developer control over the assignment of requests to threads.

Orbix 6.3

In Orbix 6.3, request processing conforms to the CORBA 2.6 specification. Each POA can have its own threading policy:

- `SINGLE_THREAD_MODEL` ensures that all servant objects in that POA have their functions called in a serial manner. In Orbix 6.3, servant code is called only by the main thread, therefore no locking or concurrency-protection mechanisms need to be used.
- `ORB_CTRL_MODEL` leaves the ORB free to dispatch CORBA invocations to servants in any order and from any thread it chooses.

Orbix 6.3 request processing extensions

Because the CORBA 2.6 specification does not specify exactly what happens when the `ORB_CTRL_MODEL` policy is chosen, Orbix 6.3 makes some proprietary extensions to the threading model.

The multi-threaded processing of requests is controlled using the Orbix 6.3 work queue feature. Two kinds of work queue are provided by Orbix 6.3:

- *Automatic Work Queue*: A work queue that feeds a thread pool. When a POA uses an automatic work queue, request events are automatically dequeued and processed by threads. The size of the thread pool is configurable.
- *Manual Work Queue*: A work queue that requires the developer to explicitly dequeue and process events.

Manual work queues give developers greater flexibility when it comes to multi-threaded request processing. For example, prioritized processing of requests could be implemented by assigning high-priority CORBA objects to one POA instance and low-priority CORBA objects to a second POA instance. Given that both POAs are associated with manual work queues, the developer can write threading code that preferentially processes requests from the high-priority POA.

Accessing the Client's TCP/IP Details

Recommendations for Orbix 6.3

Some Orbix 3 applications use Orbix-specific extensions to access socket-level information, such as the caller's IP address, in order to implement proprietary security features. These features are not available in Orbix 6.3, because providing access to low-level sockets would considerably restrict the flexibility of CORBA invocation dispatch.

To provide security for your applications, it is recommended that you use an implementation of the security service provided with the Orbix 6.3 Enterprise Edition instead.

Security Using an Authentication Filter

Recommendations for Orbix 6.3

Some Orbix 3 applications use authentication filters to implement security features. In Orbix 6.3, it is recommended that you use the security service that is made available with the Orbix 6.3 Enterprise Edition.

Loaders

Orbix 3 loader

The Orbix 3 loader provides support for the automatic saving and restoration of persistent objects. The loader provides a mechanism that loads CORBA objects automatically into memory, triggered in response to incoming invocations.

Servant manager

The Orbix 3 loader is replaced by equivalent features of the Portable Object Adapter (POA) in Orbix 6.3. The POA can be combined with a servant manager to provide functionality equivalent to the Orbix 3 loader. There are two different kinds of servant manager:

- *Servant activator*: Triggered only when the target CORBA object cannot be found in memory.
- *Servant locator*: Triggered for every invocation.

Servant activator

Taking the `PortableServer::ServantActivator` class as an example, the member functions of `CORBA::LoaderClass` correspond approximately as shown in Table 7.

Table 7 Comparison of Loader with Servant Activator Class

CORBA::LoaderClass Member Function	**ServantActivator Member Function**
`save()`	`etherealize()`
`load()`	`incarnate()`
`record()`	*No equivalent function.* An Orbix 6.3 object ID (equivalent to an Orbix 3 marker) can be specified at the time a CORBA object is created. This gives sufficient control over object IDs.

CORBA::LoaderClass Member Function	ServantActivator Member Function
`rename()`	*No equivalent function.* An Orbix 6.3 object ID (equivalent to an Orbix 3 marker) cannot be changed after a CORBA object has been created.

Servant locator

A servant locator can also be used to replace the Orbix 3 loader. In general, the servant locator is more flexible than the servant activator and offers greater scope for implementing sophisticated loader algorithms.

Smart Proxies

Orbix 3

The Orbix 3 smart proxies feature is a proprietary mechanism for overriding the default implementation of the proxy class. This allows applications to intercept outbound client invocations and handle them within the local client process address space, rather than using the default proxy behavior of making a remote invocation on the target object. Smart proxies can be used for such purposes as client-side caching, logging, load-balancing, or fault-tolerance.

Orbix 6.3

Orbix 6.3 does not support smart proxies. The primary difficulty is that, in the general case, it is not possible for the client-side ORB to determine if two object references denote the same server object. The CORBA standard restricts the client-side ORB from interpreting the object key or making any assumptions about it. Orbix 3 was able to avoid this limitation by making assumptions about the structure of the object key. This is neither CORBA-compliant nor interoperable with other ORBs.

At best, the ORB can only determine that two object references are equivalent if they have exactly the same server location (host and port in IIOP) and object key. Unfortunately, this can be an unreliable indicator if object references pass through bridges, concentrators, or firewalls that change the server location or object key.

In this case, it is possible for two object references denoting the same CORBA object to appear different to the ORB, and thus have two different smart proxy instances. Since smart proxies are commonly used for caching, having two smart proxy instances for a single CORBA object is unacceptable.

Replacing smart proxies

Table 8 shows how smart proxy tasks can be mapped to equivalent features in Orbix 6.3.

Table 8 Orbix 6.3 Alternatives to Smart Proxy Features

Orbix 3 Smart Proxy Task	Orbix 6.3 Equivalent Feature
Fault tolerance	Orbix 6.3 high availability, based on server clusters.
Logging	Orbix 6.3 built-in logging facility or portable interceptors
Caching	Implement smart proxy-like functionality by hand.

Fault tolerance

Fault tolerance is provided by the high availability feature of the Orbix 6.3's locator. See High availability.

Logging

For logging that requires access to request parameters, portable interceptors can be used in Orbix 6.3. Portable interceptors are similar to Orbix 3 filters, but they are more flexible in that they allow you to read request parameters.

Caching

A smart proxy that implements client-side caching of data cannot be mimicked by a standard Orbix 6.3 feature. In this case, you have no option but to implement smart proxy-like functionality in Orbix 6.3, and this can be done as follows:

1. Create a local implementation of the object to be proxified, by writing a class that derives from the client-side stub class.
2. Every time the client receives an object reference of the appropriate type, wrap the object reference with a corresponding smart proxy object. Before wrapping the object reference, however, you must determine the target object's identity by making an invocation on the remote target object, asking it

for a system-wide unique identifying name. This is the key step that avoids the object identity problem described in Orbix 6.3.

Based on the system-wide unique identifying name, the application can then either create a new smart proxy, or reuse the target object's existing smart proxy. The client application should consistently use the smart proxy in place of the regular proxy throughout the application.

Transformers

Orbix 3

Transformers are a deprecated feature of Orbix 3 that allow you to apply customized encryption to CORBA request messages. This could be used to implement a primitive substitute for a security service.

Orbix 6.3

In Orbix 6.3, transformers are not supported. It is recommended, instead, that you use the security service that is made available with the enterprise edition of Orbix 6.3.

I/O Callbacks

Orbix 6.3 does not allow access to TCP/IP sockets or transport-level information. This is incompatible with the Orbix 6.3 architecture, which features a pluggable transport layer. Using Orbix 6.3, you can replace TCP/IP with another transport plug-in such as IP multicast (which is connectionless), simple object access protocol (SOAP), hypertext transfer protocol (HTTP), asynchronous transfer mode (ATM), and so on. For example, the shared memory transport (SHMIOP) does not use file descriptors or sockets.

Purposes for using I/O callbacks

Orbix 3 I/O Callback functionality is generally used for two main purposes:

- *Connection Management*—the number of TCP/IP connections that can be made to a single process is typically subject to an operating system limit. Some form of connection management is required if this limit is likely to be reached in a deployed system.
- *Session Management*—I/O Callback functionality can be used to implement an elementary session-tracking mechanism. The opening of a connection from a client defines the beginning of a session and the closing of the connection defines the end of the session.

Because Orbix 6.3 has no equivalent to the Orbix 3 I/O Callback functionality, you must migrate any code that uses it.

Connection Management

Active connection management

Orbix 6.3 provides an active connection manager (ACM) that allows the ORB to reclaim connections automatically, and thereby increases the number of clients that can use a server beyond the limit of available file descriptors.

ACM configuration variables

IIOP connection management is controlled by four configuration variables:

- `plugins:iiop:incoming_connections:hard_limit` sets the maximum number of incoming (server-side) connections allowed to IIOP. IIOP refuses new connections above this limit.
- `plugins:iiop:`
- `plugins:iiop:outgoing_connections:hard_limit` sets the maximum number of outgoing (client-side) connections allowed to IIOP. IIOP refuses new outgoing connections above this limit.
- `plugins:iiop:outgoing_connections:soft_limit` specifies the number of connections at which IIOP begins closing outgoing (client-side) connections.

Closing client connections

The ORB first tries to close idle connections in least-recently-used order. If there are no idle connections, the ORB closes busy connections in least-recently-opened order.

Active connection management effectively remedies file descriptor limits that has constrained past Orbix applications. If a client is idle for a while and the server ORB reaches its connection limit, it sends a GIOP `CloseConnection` message to the client and closes the connection. Later, the same client can transparently reestablish its connection, to send a request without throwing a CORBA exception.

> **Note**
>
> In Orbix 3, Orbix tended to throw a `COMM_FAILURE` on the first attempt at reconnection; server code that anticipates this exception should be reevaluated against current functionality.

Default file descriptor limits

Orbix 6.3 is configured to use the largest upper file descriptor limit on each supported operating system. On UNIX, it is typically possible to rebuild the kernel to obtain a larger number. However, active connection management should make this unnecessary.

Session Management

Because Orbix 6.3 features a pluggable transport layer, it is not appropriate to relate the duration of a client session to the opening and closing of TCP/IP connections from clients. This type of session management, which is typically implemented using I/O callbacks in Orbix 3, has to be migrated to an alternative model.

Session management in Orbix 6.3

Support for session management in Orbix 6.3 is provided by a *lease plug-in*. The lease plug-in implements a scheme for automatically tracking client sessions, based on the idea that a client obtains a lease from the server for the duration of a client session.

Client migration

Client applications can easily be modified to use session management. Just edit the Orbix 6.3 configuration to make the client load the lease plug-in. No changes to the client source code are required.

Server migration

On the server side, the following changes are required to use session management in Orbix 6.3:

- Edit the Orbix 6.3 configuration to make the server load the lease plug-in.
- Modify the server source code so that it uses the lease plug-in to track client sessions.

Further details

See the *CORBA Session Management Guide* for details of how to program and configure the lease plug-in for session management.

Demonstration code for the lease plug-in is also provided with the Orbix 6.3 product.

CORBA Services

Orbix includes several CORBA services, such as the interface repository, the naming service, the notification service, and the security service. Because these service are based mainly on the CORBA standard, there are not many changes between Orbix 3 and Orbix 6.3.

Interface Repository

Migration

Migrating source code that uses the Interface Repository (IFR) to Orbix 6.3 is straightforward. Link the migrated application against the stub code derived from the Orbix 6.3 version of the interface repository. No further changes should be necessary.

Naming Service

Backward compatibility

The Orbix 6.3's naming service is backward compatible with Orbix 3.x in two respects:

- *Source code backward compatibility*: source code that is written to use the standard naming service interfaces can be migrated to Orbix 6.3 without modification.
- *On-the-wire backward compatibility*: Orbix 3.x applications can interoperate with the Orbix 6.3 naming service. If you need to interoperate Orbix 3.x applications, it is recommended that you recompile the naming stub code from the Orbix 6.3 IDL files.

New interface

Orbix 6.3 adds a new interface, `CosNaming::NamingContextExt`, which is defined by the CORBA Interoperable Naming Service specification. This interface adds support for using names in stringified format.

Load balancing

The naming service load-balancing extensions provided in Orbix 3 are also present in Orbix 6.3. The Orbix 6.3 load-balancing interfaces are only slightly different from Orbix 3, requiring small modifications to your source code.

Notification Service

The Orbix 6.3 notification service has undergone significant modifications since the OrbixNotification 3 generation of the notification service.

Many of the changes that impact application migration reflect changes in the CORBA standard and require minimal changes to legacy OrbixNotification 3 application code.

CORBA Specification Updates

The Orbix 6.3 notification service complies with both the CORBA 2.6 specification and the OMG's Notification Service Specification, approved in June of 2000. To achieve compliance with these specifications several changes were made to the notification services IDL and APIs.

These changes require that any applications that use generation 3 code need to be recompiled and re-linked, at the very least. Other minor changes might also need to be made to generation 3 code to accommodate the changes in the APIs. Compiler warnings warn you of most changes that need to be made.

_bind()

The Orbix 6.3 notification service clients do not use `_bind()` to contact the notification service. Instead, clients should call `resolve_initial_references("NotificationService")` to obtain an object reference to the notification service. See Replacing the _bind() Function for more information.

Subscription and publication notification

Orbix 6.3 provides notification service clients greater flexibility over how they receive subscription and publication details from the notification channel. To accomplish this, an input parameter has been added to `obtain_offered_types()` and `obtain_subscription_types()`.

The Orbix 6.3 operation signatures are:

```
// IDL
CosNotification::EventTypeSeq obtain_subscription_types(
in ObtainInfoMode mode);
CosNotification::EventTypeSeq obtain_offered_types(
in ObtainInfoMode mode);
```

The new parameter is of type `ObtainInfoMode` which is an `enum` defined in `CosNotifyChannelAdmin` as:

```
// IDL
enum ObtainInfoMode
{
ALL_NOW_UPDATES_OFF,
ALL_NOW_UPDATES_ON,
NONE_NOW_UPDATES_OFF,
NONE_NOW_UPDATES_ON
};
```

Any generation 3 clients that call `obtain_offered_types()` or `obtain_subscription_types()` need to add the parameter. `ALL_NOW_UPDATES_OFF` mimics generation 3 functionality. For more information on the other values, see the *CORBA Notification Service Guide*.

Unstructured event clients

Orbix 6.3 introduces unstructured event, any-style, client interfaces into the `CosNotifyComm` module. This allows any-style clients to support the enhanced subscription features and it standardizes notification service client development. Any-style clients developed for OrbixNotification 3 use the interfaces from `CosEventComm`.

In addition, the Orbix 6.3 any-style proxy interfaces, defined in `CosNotifyChannelAdmin`, inherit their client interfaces directly from `CosNotifyComm`. In OrbixNotification 3 any-style proxies inherit client interfaces from `CosNotifyComm:NotifyPublish` and `CosEventComm::PushConsumer`.

> **Note**
>
> The `connect()` operation's parameter is still an interface defined in `CosEventComm`.

Not updating legacy code does not generate any compiler errors. However, at runtime any-style clients using legacy code are not able to contact the notification service.

TimeBase::TimeT

Orbix 6.3 supports the new OMG standard definition of `TimeBase::TimeT`. In OrbixNotification 3 `TimeBase::TimeT` is defined as a structure containing two `unsigned longs`. In Orbix 6.3 it is defined as a `CORBA::ULongLong`.

Any generation 3 clients that use the timing features of the service need to be updated to support the new definition of `TimeBase::TimeT`. If they are not, the Orbix 6.3 notification service generates mashalling errors at runtime.

Quality of Service Properties

Orbix 6.3 notification service uses new several new Quality-of-Service (QoS) properties and has reimplemented others.

PacingInterval

`PacingInterval` is re-implemented as a `TimeBase::TimeT` in Orbix 6.3 and is specified in units of 10-7 seconds. In Orbix 3 it is a `TimeBase:UtcT` and is specified in milliseconds.

Orbix 6.3 QoS properties

Table 9 lists the new Orbix 6.3 QoS properties. For more detailed information on Orbix 6.3 QoS properties, see the *CORBA Notification Service Guide*.

Table 9 Orbix 6.3 QoS Properties

QoS Property	Description
`MaxEventsPerConsumer`	Specifies the maximum number of undelivered events that a channel will queue for a consumer. It is set with a `long` and is valid for supplier proxies, consumer admins, and notification channels.
`MaxRetries`	Specifies the maximum number of times a proxy push supplier calls `push()` on its consumer before giving up, or the maximum number of times a proxy pull consumer calls `pull()` or `try_pull()` on its supplier before giving up. It is set with a `CORBA::Ulong` and is valid for consumer admins and notification channels.
`RetryTimeout`	Specifies the amount of time that elapses between attempts by a proxy push supplier to call `push()` on its consumer. It is set with a `TimeBase::TimeT` and defaults to 1 second.
`MaxRetryTimeout`	Sets the ceiling for the calculated value of `RetryTimeout`. It is set with a `TimeBase::TimeT` and defaults to 60 seconds.
`RequestTimeout`	Specifies the amount of time a channel object has to perform an operation on a client. It is set using a `TimeBase::TimeT`.
`PullInterval`	Specifies the amount of time that elapses between attempts by a proxy pull consumer to call `pull()` or `try_pull()` on its consumer. It is specifies with a `long` and defaults to 1 second.

QoS Property	Description
`RetryMultiplier`	Specifies the number used to calculate the amount of time between attempts by a proxy push supplier to call `push()` on its consumer. It is set with a `CORBA::double` and defaults to 1.0.

Channel administration properties

Orbix 6.3 has introduced two properties to control the administration of a notification channel. These properties can only be set on a notification channel. For more information, see the *CORBA Notification Service Guide*.

Table 10 describes the new properties.

Table 10 Orbix 6.3 Administration Properties

Property	Description
`MaxConsumers`	Specifies the maximum number of consumers that can be connected to a channel at a given time. It is set using a `long` and defaults to 0 (unlimited).
`MaxSuppliers`	Specifies the maximum number of suppliers that can be connected to a channel at a given time. It is set using a `long` and defaults to 0 (unlimited).

Configuration/Administration Changes

Centralized configuration

Orbix 6.3 has a centralized configuration mechanism. This means that the notification service is configured using the standard Orbix 6.3 configuration tools and the information is stored in the common Orbix 6.3 database.

Starting the notification service

The Orbix 6.3 notification service can be configured to start on system boot, on demand, or from the command line.

To start the notification service from the command line use:

```
itnotify run [-backround]
```

The `-background` flag is optional and starts the notification service to run as a background process.

Managing the notification service

The Orbix 6.3 notification service can be managed in one of two ways.

- The Orbix 6.3 `itadmin` tool. For more information, see the *CORBA Administrator's Guide*.
- The Orbix 6.3 notification console, `itnotifyconsole`. For more information on using the console, see the *CORBA Notification Service Guide*.

Configuration variables

The Orbix 6.3 notification service uses a new set of configuration variables. See the *CORBA Administrator's Guide* for a detailed listing of the new configuration variables.

Deprecated Features

Orbix 6.3 has deprecated some proprietary features from OrbixNotification 3. Any notification clients that make use of these features need to be updated.

HealthCheck

The OrbixNotification 3 HealthCheck feature allows notification channels, and optionally notification clients, to monitor their connections. In Orbix 6.3 this feature is no longer supported.

Code Modification

To find code using the HealthCheck feature search for the following strings:

- `DO_HEALTHCHECK`

- `DO_GL_HEALTHCHECK`
- `initializeHealthCheck`
- `startHealthCheck`
- `stopHealthCheck`
- `HealthCheck.h`

This code must be removed before the clients can be compiled using the Orbix 6.3 libraries.

Simulating HealthCheck in Orbix 6.3

HealthCheck-like functionality is implemented in Orbix 6.3, using the `MaxRetries` QoS property. If a `ProxyPushSupplier` or a `ProxyPullConsumer` fails to communicate with its associated client in `MaxRetries` attempts, the notification channel forces a disconnect and destroys all of the resources used to support the client.

String events

Orbix 6.3 no longer supports string events. All generation 3 clients using string events must be rewritten to use a valid event type.

SSL/TLS Toolkit

This section describes how to migrate from OrbixSSL or Orbix 3.3 security to the Orbix 6.3 SSL/TLS security service. Orbix 6.3 SSL/TLS has a very similar set of features to Orbix 3.3 security and it supports interoperability with legacy Orbix applications (see SSL/TLS Toolkit Interoperability).

The programming interfaces and administration of security have, however, changed significantly between Orbix 3.3 and Orbix 6.3. This section provides an overview of these changes.

Changes to the Programming Interfaces

Support for security level 2

The APIs for Orbix 6.3 SSL/TLS are based on the CORBA security level 2 interfaces. The programming interface is, therefore, based on the following standard IDL modules:

- `Security`
- `SecurityLevel1`
- `SecurityLevel2`

> **Note**
>
> Orbix 6.3 SSL/TLS does not implement every interface in the `SecurityLevel1` and `SecurityLevel2` modules. The CORBA security API is a mechanism-neutral API that can be layered over a variety of security toolkits. Some of the standard interfaces are more appropriately implemented by a higher level security layer.

CORBA policy-based API

In contrast to OrbixSSL 3.x, the Orbix 6.3 SSL/TLS product supports a *CORBA policy-based* approach to setting security properties. This represents a significant enhancement over OrbixSSL 3.x, because the policy-based approach lets you set properties at a finer granularity than before.

For example, client policies can be set at the following levels:

- ORB
- Thread
- Object reference

Server policies can be set at the following levels:

- ORB
- POA

No support for certificate revocation lists

Orbix 6.3 SSL/TLS has no support for certificate revocation lists (CRL). Therefore, the following OrbixSSL 3.x interfaces have no Orbix 6.3 equivalent:

```
IT_CRL_List
IT_X509_CRL_Info
IT_X509_Revoked
IT_X509_RevokedList
```

If you require certificate revocation in Orbix 6.3, you can programmatically implement any required revocation checks by registering a certificate validator policy, `IT_TLS_API::CertValidatorPolicy`.

Mechanism-specific API

Orbix 6.3 SSL/TLS provides a number of value-added APIs that deal with the mechanism-specific aspects of the SSL/TLS toolkit. The extra IDL interfaces provide the facility to parse X.509 certificates and set Orbix-specific security policies.

The mechanism-specific API is defined by the following IDL modules:

- `IT_Certificate`
- `IT_TLS`
- `IT_TLS_API`

Migrating OrbixSSL 3.x classes and data types

When migrating to Orbix 6.3, most of the old C++ and Java classes from OrbixSSL 3.x are replaced by equivalent IDL interfaces. Table 11 shows which OrbixSSL classes and data types to replace by the equivalent Orbix 6.3 SSL/TLS types.

Table 11 Mapping OrbixSSL 3.x Types to Orbix 6.3 SSL/TLS

OrbixSSL 3.x Type	Orbix 6.3 SSL/TLS Equivalent
`IT_AVA`	`IT_Certificate::AVA`
`IT_AVAList`	`IT_Certificate::AVAList`
`IT_CertError`	`IT_Certificate::CertError`
`IT_CRL_List`	*No equivalent*

OrbixSSL 3.x Type	Orbix 6.3 SSL/TLS Equivalent
`IT_Extension`	`IT_Certificate::Extension`
`IT_ExtensionList`	`IT_Certificate::ExtensionList`
`IT_OID`	`IT_Certificate::ASN_OID`
`IT_OIDTag`	`IT_Certificate::OIDTag`
`IT_SSL`	Equivalent functionality provided by the `Security`, `SecurityLevel1`, `SecurityLevel2`, and `IT_TLS_API` IDL modules.
`IT_UTCTime`	`IT_Certificate::UTCTime`
`IT_ValidateX509CertCB`	Use a combination of the `IT_TLS::CertValidator` interface and the `IT_TLS_API::CertValidatorPolicy` interface.
`IT_X509_CRL_Info`	*No equivalent*
`IT_X509_Revoked`	*No equivalent*
`IT_X509_RevokedList`	*No equivalent*
`IT_X509Cert`	`IT_Certificate::X509Cert`
`IT_X509CertChain`	`IT_Certificate::X509CertChain`

Configuration and Administration

Enabling security in Orbix 6.3

Security in Orbix 6.3 is enabled by configuring an application to load the security plug-in, `iiop_tls`.This is a relatively simple procedure involving just a few changes in the Orbix 6.3 configuration file; although advanced applications might also need to use security APIs.

Because application security is controlled by editing the configuration file, you must ensure that access to the configuration file is restricted.

External configuration granularity

The external configuration granularity refers to the effective scope of security configuration settings that are made in a configuration file. The external configuration granularity is mapped as follows:

- In OrbixSSL 3.x, it is identified with a process.
- In Orbix 6.3 SSL/TLS, it is identified with a single ORB instance.

KDM support

The key distribution management (KDM) is a framework that enables automatic activation of secure servers. Both OrbixSSL 3.x and Orbix 6.3 SSL/TLS provide a KDM and the functionality is similar in each.

There is one significant difference between the OrbixSSL 3.x KDM and the Orbix 6.3 KDM. Protection against server impostors implemented differently in the two products:

- In OrbixSSL 3.x, a binary checksum is calculated from the contents of the server executable file. The server is launched only if the calculated checksum matches the cached value.
- In Orbix 6.3 SSL/TLS, the node daemon relies on the server executables being stored in a secured directory to prevent tampering. A different sort of checksum is calculated (based on the contents of the server activation record) to ensure that the node daemon cannot be fooled into launching a server from an insecure directory.

No CRL support

Orbix 6.3 SSL/TLS does not support certificate revocation lists. Hence, there are no equivalents for the corresponding OrbixSSL 3.x configuration variables. See also No support for certificate revocation lists.

Migrating OrbixSSL 3.x configuration

Most of the OrbixSSL 3.x configuration variables have direct equivalents in Orbix 6.3, as shown in Table 12. In addition, many of the properties listed in Table 12 can also be set programmatically in Orbix 6.3.

Table 12 Mapping OrbixSSL 3.x Configuration Variables to Orbix 6.3

OrbixSSL 3.x Configuration Variable	Orbix 6.3 SSL/TLS Equivalent
`IT_CA_LIST_FILE`	`policies:trusted_ca_list_policy`
`IT_AUTHENTICATE_CLIENTS`	`policies:target_secure_invocation_policy`
`IT_SERVERS_MUST_AUTHENTICATE_CLIENTS.`	`policies:target_secure_invocation_policy`
`IT_INVOCATION_POLICY`	`policies:target_secure_invocation_policy` `policies:client_secure_invocation_policy`

`IT_SECURE_REMOTE_INTERFACES` `IT_SECURE_SERVERS`
`IT_INSECURE_REMOTE_INTERFACES`
`IT_INSECURE_SERVERS`
	These properties cannot currently be specified in the Orbix 6.3 configuration file.
	
	You can, however, set the properties programmatically using the following interfaces:
	
	`SecurityLevel2::EstablishTrustPolicy`
	`SecurityLevel2::QOPPolicy`

`IT_CIPHERSUITES`	`policies:mechanism_policy`
`IT_ALLOWED_CIPHERSUITES`	*No equivalent in Orbix 6.3.*
`IT_CERTIFICATE_FILE` `IT_CERTIFICATE_PATH`	Equivalent functionality provided by: `principal_sponsor:auth_method_data`
`IT_BIDIRECTIONAL_IIOP_BY_DEFAULT`	*No equivalent in Orbix 6.3.*

OrbixSSL 3.x Configuration Variable	Orbix 6.3 SSL/TLS Equivalent
`IT_CACHE_OPTIONS`	`policies:session_caching_policy` `plugins:atli_tls_tcp:session_cache_validity_period` `plugins:atli_tls_tcp:session_cache_size`
`IT_DEFAULT_MAX_CHAIN_DEPTH`	`policies:max_chain_length`
`IT_MAX_ALLOWED_CHAIN_DEPTH.`	*No equivalent in Orbix 6.3.*
`IT_DAEMON_POLICY` `IT_DAEMON_UNRESTRICTED_METHODS` `IT_DAEMON_AUTHENTICATES_CLIENTS` `IT_ORBIX_BIN_SERVER_POLICY`	In Orbix 6.3, the services are configured using standard Orbix 6.3 configuration variables such as the secure invocation policies.
`IT_DAEMON_UNRESTRICTED_METHODS`	*No equivalent in Orbix 6.3.* There is currently no concept of service authorization in Orbix 6.3.
`IT_FILTER_BAD_CONNECTS_BY_DEFAULT`	Not needed in Orbix 6.3.
`IT_ENABLE_DEFAULT_CERT`	Not needed in Orbix 6.3. There is no need for this option because Orbix 6.3 supports security unaware applications.
`IT_DISABLE_SSL`	Not needed in Orbix 6.3. Configure your application not to load the security plug-in.
`IT_KDM_CLIENT_COMMON_NAMES` `IT_KDM_ENABLED` `IT_KDM_PIPES_ENABLED` `IT_KDM_REPOSITORY` `IT_KDM_SERVER_PORT`	Equivalent functionality is provided by the KDM in Orbix 6.3. See the *CORBA SSL/TLS Guide*.

OrbixSSL 3.x Configuration Variable	Orbix 6.3 SSL/TLS Equivalent
`IT_CHECKSUMS_ENABLED` `IT_CHECKSUM_REPOSITORY`	*No equivalent in Orbix 6.3.* There is no binary checksum functionality in Orbix 6.3. Orbix 6.3 SSL/TLS relies on storing server executables in secured directories.
`IT_CRL_ENABLED` `IT_CRL_REPOSITORY` `IT_CRL_UPDATE_INTERVAL`	*No equivalent in Orbix 6.3.* There is no CRL functionality in Orbix 6.3.

Migrating Certificate and Private Key Files

In OrbixSSL 3.x, a variety of certificate and private key formats are used in different parts of the product. Orbix 6.3 SSL/TLS is based on a unified certificate file format, the industry standard PKCS#12 format, and the PEM format for storing trusted CA certificates. This subsection describes how to convert each of the legacy formats to PKCS#12.

Certificate file formats

The following certificate file formats are used by OrbixSSL 3.x and Orbix 6.3 SSL/TLS:

- *Privacy enhanced mail (PEM) format*—A PEM file typically contains a single certificate. OrbixSSL 3.x can use this format to hold peer certificates. Orbix 6.3 SSL/TLS *cannot* use this format for peer certificates.
- *PKCS#12 format*—A PKCS#12 file contains a peer certificate chain, concatenated with a private key at the end. Both OrbixSSL 3.x and Orbix 6.3 SSL/TLS can use this format for peer certificates.

Migrating certificate files

You can migrate OrbixSSL 3.x certificate files to Orbix 6.3 SSL/TLS as shown in Table 13.

Table 13 Converting Certificate Files

Source OrbixSSL 3.x File Format	Target Orbix 6.3 File SSL/TLS Format	How to Convert
PEM format	PKCS#12 format	Use the `openssl pkcs12` utility, specifying the complete peer cert chain, private key and pass phrase.
PKCS#12 format	PKCS#12 format	*No conversion needed.*

Private key file formats

The following private key file formats are used by OrbixSSL 3.x and Orbix 6.3 SSL/TLS:

- *PKCS#1 format*—An unencrypted private key format. Orbix 6.3 SSL/TLS only supports this format programmatically.
- *PKCS#8 format*—An encrypted private key format. Orbix 6.3 SSL/TLS only supports this format programmatically.
- *OpenSSL proprietary private key format*—A proprietary encrypted format generated by the OpenSSL toolkit utilities.
- *Proprietary KEYENC format (deprecated)*—An encrypted private key format generated by the OrbixSSL 3.x `keyenc` utility. This format was formerly used by OrbixSSL 3.x Java applications and is now deprecated.

Migrating key files

You can migrate OrbixSSL 3.x private key files to Orbix 6.3 SSL/TLS as shown in Table 14.

Table 14 Converting Private Key Files

Source OrbixSSL 3.x File Format	Target Orbix 6.3 SSL/TLS File Format	How to Convert
PKCS#1 format	PKCS#12 format	Use the `openssl pkcs12` utility, specifying the complete peer cert chain, private key, and pass phrase.
OpenSSL proprietary encrypted private key format	PKCS#12 format	Convert as follows: 1. Decrypt using the `openssl rsa` command. 2. Encrypt as PKCS#12 using the `openssl pkcs12` utility, specifying the complete peer cert chain, private key, and pass phrase.
Proprietary `keyenc` format	PKCS#12 format	Convert as follows: 1. Decrypt using the `keyenc -d` command: 2. Encrypt as PKCS#12 using the `openssl pkcs12` utility, specifying the complete peer cert chain, private key, and pass phrase.

Trusted CA certificate lists

In both OrbixSSL 3.x and Orbix 6.3 SSL/TLS, a trusted CA certificate list file consists of a concatenated list of PEM certificates.

Note

The Orbix 6.3 SSL/TLS Java Edition product currently does not accept any extraneous text (comments and so on) in a trusted CA list file. The extra text must therefore be removed if you are using Orbix 6.3 SSL/TLS Java Edition.

Interoperability

In a mixed system containing Orbix 3.3 Java Edition and Orbix 6.3 SSL/TLS, the PKCS#12 format can be used for peer certificates because Orbix 3.3 Java Edition also accepts the PKCS#12 format.

Administration

The administration of Orbix 6.3 has changed significantly from Orbix 3. This chapter provides a brief overview of the main changes in Orbix administration.

Orbix Daemons

Orbix 6.3 daemons

To provide greater flexibility and scaling, Orbix 6.3 replaces the Orbix 3 daemon, `orbixd`, with two daemons:

- The locator daemon, `itlocator`, helps clients to find Orbix 6.3 servers.
- The node daemon, `itnode_daemon`, launches dormant Orbix 6.3 servers in response to a client's request for service.

POA Names

Administering POA Names

In Orbix 3, CORBA objects were associated with a named server. In Orbix 6.3, CORBA objects are associated with named POAs. This means that Orbix 6.3 object references include an embedded POA name instead of a server name.

The Orbix 6.3 locator daemon locates the CORBA object using the object reference's embedded POA name. Hence, POA names play a major role in configuring the Orbix 6.3 locator daemon.

Command-Line Administration Tools

Orbix 6.3 unifies many of Orbix 3's command-line tools under a single utility, `itadmin`. Also, some of the Orbix 3 command line-tools have been deprecated.

General command-line tools

Table 15 compares the Orbix 3 general purpose command-line tools with the Orbix 6.3's tools.

Table 15 Comparison of Orbix 3 and Orbix 6.3 General Command-Line Tools

Description	Orbix 3	Orbix 6.3
Show implementation repository (IMR) entry.	`catit`	`itadmin process show`
Security commands.	`chownit`, `chmodit`	*No equivalent*
Show configuration.	`dumpconfig`	`itadmin config dump`
Associate hosts into groups.	`grouphosts`	*No equivalent*
C++ IDL compiler.	`idl`	`idl`
CodeGen toolkit.	`idlgen`	`idlgen`
Java IDL compiler.	`idlj`	`idl`
Interface Repository (IFR).	`ifr`	`itifr`
Kill a server process.	`killit`	`itadmin process stop`
List server.	`lsit`	`itadmin process list`
Create a sub-directory in the IMR.	`mkdirit`	*No equivalent*
Orbix daemon.	`orbixd`	`itlocator` and `itnode_daemon`
Ping the Orbix daemon.	`pingit`	*No equivalent*
List active servers.	`psit`	`itadmin process list -active`
Add a definition to the IFR.	`putidl`	`idl -R`

Description	Orbix 3	Orbix 6.3
Register a server in the IMR.	`putit`	`itadmin process create`
Show an IFR definition.	`readifr`	`itadmin ifr show`
Remove a sub-directory from the IMR.	`rmdirit`	*No equivalent*
Unregister a server from the IMR.	`rmit`	`itadmin process remove`
Remove a definition from the IFR.	`rmidl`	`itadmin ifr remove`
Associate servers with groups.	`servergroups`	*No equivalent*
Associate hosts with servers.	`serverhosts`	*No equivalent*

Naming Service Command Line Tools

Table 16 compares the Orbix 3 naming service command-line tools with the Orbix 6.3 tools.

Table 16 Comparison of Orbix 3 and Orbix 6.3 Naming Service Command-Line Tools

Description	Orbix 3	Orbix 6.3
Add a member to an object group.	`add_member`	`itadmin nsog add_member`
Print the IOR of an object group.	`cat_group`	*No equivalent*
Print the IOR of an object group's member.	`cat_member`	`itadmin nsog show_member`
Print the IOR of a given name.	`catns`	`itadmin ns resolve`
Remove an object group.	`del_group`	`itadmin nsog remove`
Remove a member from an object group.	`del_member`	`itadmin nsog remove_member`
List all object groups.	`list_groups`	`itadmin nsog list`
List the members of an object group.	`list_members`	`itadmin nsog list_member`
List the bindings in a context.	`lsns`	`itadmin ns list`
Create an object group.	`new_group`	`itadmin nsog create`

Description	Orbix 3	Orbix 6.3
Create an unbound context.	`newncns`	`itadmin ns newnc`
Select a member of an object group.	`pick_member`	*No equivalent*
Bind a name to a context.	`putncns`	`itadmin ns bind -context`
Create a bound context.	`putnewncns`	`itadmin ns newnc`
Bind a name to an object.	`putns`	`itadmin ns bind -object`
Rebind a name to a context.	`reputncns`	`itadmin ns bind -context`
Rebind a name to an object.	`reputns`	`itadmin ns bind -object`
Remove a binding.	`rmns`	`itadmin ns remove`

Activation Modes

Orbix 3

Orbix 3 process activation modes, *shared*, *unshared*, *per-method*, *per-client-pid*, and *persistent* are used for a variety of reasons. For example, they are used to achieve multi-threaded behavior in a single-threaded environment, to increase server reliability, and so on. The two most popular modes are:

- *Shared mode*—which enables all clients to communicate with the same server process.
- *Per-client-pid mode*—which enforces a 1-1 relationship between client process and server process, is sometimes used to maximize server availability.

Orbix 6.3

Orbix 6.3 provides the following activation modes:

- `on_demand` —the process only activates when required.
- `per_client` —a new process is activated for each client.

  Orbix 6.3 moved CORBA object association from the server to the POA. Because of this, all Orbix 6.3 processes are shared.

Migration

Migration of source code should be straightforward, because the choice of activation mode has almost no impact on BOA or POA-based server code.

Load balancing

The additional activation modes provided by Orbix 3 are typically used to achieve some form of load-balancing that is transparent to the client. The Enterprise Edition of Orbix 6.3 includes transparent locator-based load balancing over a group of replica POAs. This answers the needs currently addressed by Orbix 3 activation modes.

Configuring for Interoperability

This section describes the main configuration changes that must be made to facilitate interoperability between Orbix 3.x and Orbix 6.3 applications.

Interoperability Overview

This Interoperability Guide describes how to configure applications that use a mixture of Orbix products and any feature limitations that apply to such interoperating systems.

Orbix 6.3 interoperability

Because Orbix 6.3 is binary-compatible with Orbix E2A ASP v6.0, Orbix 6.3 has the same interoperability characteristics as ASP 6.0.

Orbix E2A ASP v6.0 interoperability

The following product releases have been tested for interoperability with Orbix E2A ASP v6.0:

- Orbix 3.3.4 C++ Edition
- Orbix 3.3.4 Java Edition

Orbix E2A ASP v5.1 interoperability

The following product releases have been tested for interoperability with Orbix E2A ASP v5.1:

- Orbix 3.0.1-82
- OrbixWeb 3.2-15
- Orbix 3.3.2 C++ Edition
- Orbix 3.3.2 Java Edition

The _bind() function

Orbix 6.3 does not support the `_bind()` function for establishing connections between clients and servers. Neither Orbix 3.0.1-82, OrbixWeb 3.2-15, nor Orbix 3.3 clients can use the `_bind()` function to establish a connection to an Orbix 6.3 server. You must use a CORBA Naming Service instead. For example, you could use either the Orbix 3.3 naming service or the Orbix 6.3 naming service.

IDL feature support

Orbix 6.3 supports a larger set of IDL data types and features than Orbix 3.3. When developing IDL interfaces for use with Orbix 6.3 and other products you need to restrict your IDL to a subset that is supported by all of the interoperating products.

In particular, the following describe IDL features that are subject to limitations or require special configuration:

- Using the #pragma Prefix
- Use of #pragma ID in IDL
- Fixed Data Type and Interoperability
- Use of wchar and wstring
- C++ Keywords as Operation Names

Changed exception semantics

The semantics of some CORBA system exceptions are different in Orbix 6.3, as compared with Orbix 3.0.1-82, OrbixWeb 3.2-15, or Orbix 3.3. If you have existing code written for Orbix 3.0.1-82, OrbixWeb 3.2-15, or Orbix 3.3, you should read the following:

- Orbix 3.3 C++ Edition—System Exceptions
- Orbix 3.3 Java Edition—System Exceptions

  These sections describe how to configure your legacy application so that it is insulated from any differences in exception semantics.

Bidirectional GIOP

Orbix 6.3 introduces support for bidirectional GIOP, based on an OMG standard. Previously (Orbix E2A ASP v5.x and v6.0), bidirectional GIOP was not supported, or was not based on an OMG standard (Orbix 3.x and earlier).

See Callbacks and Bidirectional GIOP for details.

Other affected features

If you want to use the Orbix 6.3 interoperable naming service as the common naming service for your interoperating system, see The Orbix 6.3 Interoperable Naming Service.

The rest of this guide describe miscellaneous issues that might affect interoperability in a mixed product environment.

Launch and Invoke Rights

When an Orbix 6.3 client attempts to open a connection to an Orbix 3.0.1-82, OrbixWeb 3.2-15, or Orbix 3.3 server you must make sure that the system is configured such that the Orbix 6.3 client has launch and invoke rights.

Role of launch and invoke rights

In Orbix 3.3 the `orbixd` daemon process is responsible both for launching servers and for redirecting client requests to servers. These two functions are governed by *launch rights* and *invoke rights*, respectively.

Launch and invoke rights on Orbix 3.3 servers are based on the idea that the client *userID* is transmitted along with request messages. The field of the request message that contains the user ID is known as the Principal of the invocation.

If launch and invoke rights are not configured correctly, the Orbix 6.3 client raises a `CORBA::OBJECT_NOT_EXIST` system exception.

Setting launch rights

The launch rights associated with an Orbix 3.3 server specify which users are allowed to cause automatic launching of the server. Launch rights in Orbix 3.3 are granted with the following form of `chmodit`:

```
**chmodit l+***userID ServerName*
```

Setting invoke rights

The invoke rights associated with an Orbix 3.3 server are used to determine which users are allowed to invoke on the server. Invoke rights are granted using:

```
**chmodit i+***userID ServerName*
```

Orbix 6.3 and Orbix 3.3

The configuration must be altered for an Orbix 6.3 client invoking on an Orbix 3.3 server. There are two possible approaches to fix the launch and invoke rights:

- Alter the configuration of the Orbix 6.3 Client.
- Relax the security on the orbixd daemon.

Alter the configuration of the Orbix 6.3 Client

Three configuration variables must be made (or changed) in the Orbix 6.3 configuration file:

```
# Orbix 6.3 Configuration File
policies:giop:interop_policy:send_locate_request = "false";
policies:giop:interop_policy:send_principal = "true";
policies:giop:interop_policy:enable_principal_service_context =
"true";
```

The `policies:giop:interop_policy:send_locate_request` option controls whether Orbix 6.3 sends `LocateRequest` messages before sending initial `Request` messages. This option must be set to false because `LocateRequest` messages do not contain a Principal field.

The `policies:giop:interop_policy:send_principal` option controls whether Orbix 6.3 sends Principal information containing the current user name in GIOP 1.0 and GIOP 1.1 requests. The user name is matched against the launch and invoke rights listed in the `orbixd` daemon, to determine the permissions of the Orbix 6.3 client.

Relax the security on the orbixd daemon

Alternatively, you can relax the security on the orbixd daemon so that all clients have launch and invoke rights. For example, use the `chmodit` command line utility to change the launch and invoke rights:

```
**chmodit l+all** *ServerName*
**chmodit i+all** *ServerName*
```

These commands give permission for any client to invoke or launch the server *ServerName*. Permissions are granted even if the Principal value is left blank in the incoming requests.

GIOP Versions

GIOP version of a connection

The GIOP version used by a client-server connection is determined by the client. When a client is about to open a connection to a CORBA object, the client examines the version information in the object's IOR:

- If the GIOP version in the IOR is greater than or equal to the default GIOP version of the client, the client initiates a connection using the client's default GIOP version.
- Otherwise, the client initiates a connection using the GIOP version in the IOR.

Effect of GIOP version

The GIOP version of a connection is important, because some CORBA features are not supported in early GIOP versions. Table 17 shows the minimum GIOP version required for some CORBA features, according to the CORBA specification.

Table 17 CORBA-Specified Minimum GIOP Versions

CORBA Feature	CORBA-Specified Minimum GIOP Version
`fixed` type	1.1
`wchar` and `wstring` types	1.1
codeset negotiation (Orbix 6.3 only)	1.1

Orbix-specific minimum GIOP versions

Notwithstanding the CORBA-specified minimum GIOP versions, Orbix allows some features to be used at a lower GIOP version (in some cases requiring specific configuration variables to be set). Table 18 shows the Orbix-specific minimum GIOP versions.

Table 18 Orbix-Specific Minimum GIOP Versions

CORBA Feature	Orbix-Specific Minimum GIOP Version
`fixed` type	1.0
`wchar` and `wstring` types	1.0
codeset negotiation (Orbix 6.3 only)	1.1

For more details on these CORBA features, see these sections:

- Fixed Data Type and Interoperability.
- Use of wchar and wstring.
- Introduction to Codeset Negotiation.

Table of default GIOP versions

Table 19 shows the default GIOP versions for different Orbix clients when opening a connection to a server.

Table 19 Default GIOP Version Used by Orbix Clients

Client Version	Default GIOP Version
Orbix 3.0.1-82	1.0
OrbixWeb 3.2-15	1.0
Orbix 3.3 C++ Edition	1.1
Orbix 3.3 Java Edition	1.0
Orbix 6.3	1.1

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