Oracle® Tuxedo

Getting Started with Oracle® Tuxedo CORBA Applications

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Oracle Tuxedo Getting Started with Oracle® Tuxedo CORBA Applications, Release 22c

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Preface

The CORBA environment in the Oracle Tuxedo product is based on the CORBA standard as a programming model for developing enterprise applications with high performance, scalability, and reliability. Oracle Tuxedo CORBA extends the Object Request Broker (ORB) model with online transaction processing (OLTP) functions. The Oracle Tuxedo CORBA deployment infrastructure delivers secure, transactional, distributed applications in a managed environment.

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Overview of the Oracle Tuxedo CORBA Environment

> **Note:**
>
> The Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB were deprecated in Tuxedo 8.1 and are no longer supported. All Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB text references, associated code samples, should only be used to help implement/run third party Java ORB libraries, and for programmer reference only.
> Technical support for third party CORBA Java ORBs should be provided by their respective vendors. Oracle Tuxedo does not provide any technical support or documentation for third party CORBA Java ORBs.

This topic includes the following sections:

1.1 Introduction to the Oracle Tuxedo CORBA Environment

The CORBA environment in the Oracle Tuxedo product is based on the CORBA standard as a programming model for developing enterprise applications with high performance, scalability, and reliability. Oracle Tuxedo CORBA extends the Object Request Broker (ORB) model with online transaction processing (OLTP) functions. The Oracle Tuxedo CORBA deployment infrastructure delivers secure, transactional, distributed applications in a managed environment.

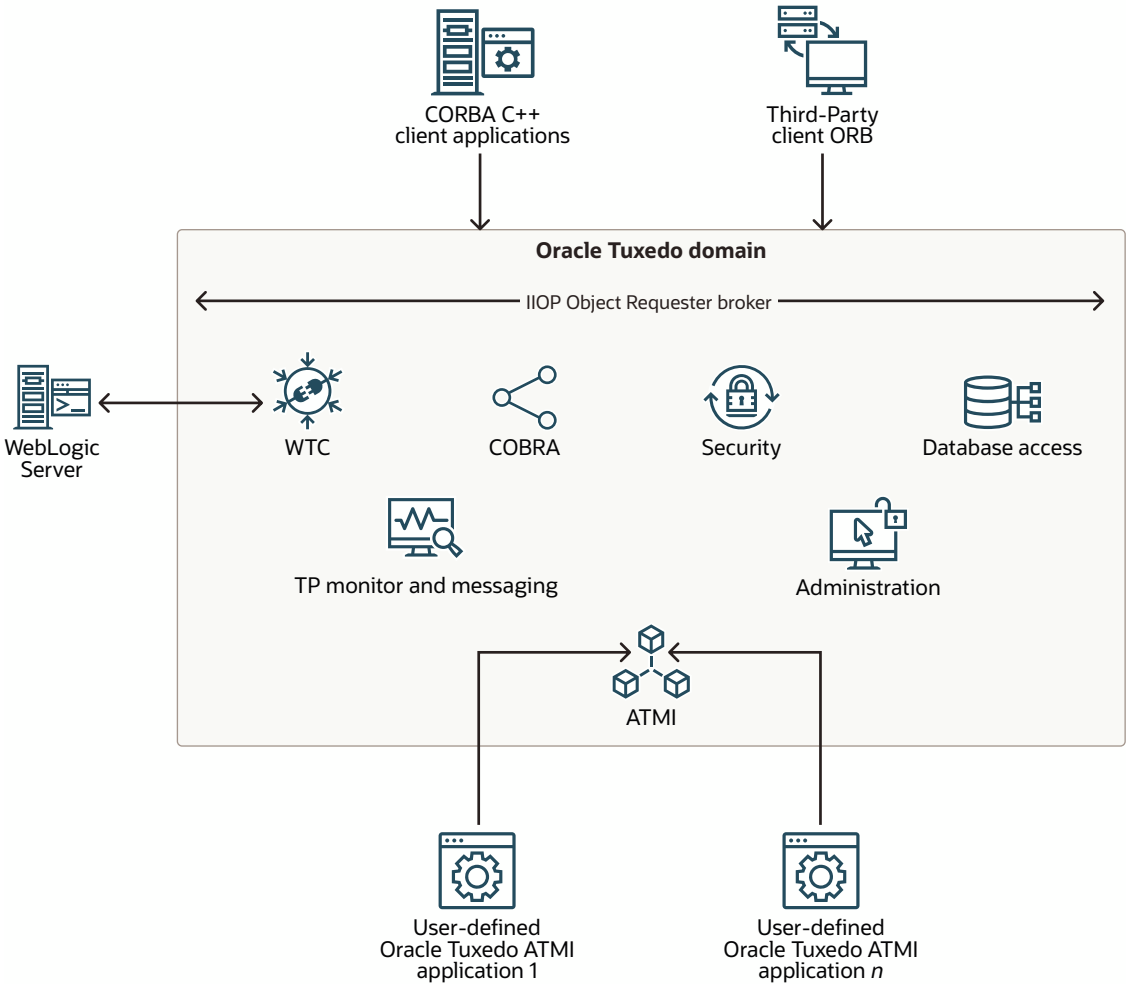
CORBA objects built with the Oracle Tuxedo product are accessible from Web-based applications that communicate using the CORBA Object Management Group (OMG) Internet Inter-ORB Protocol (IIOP). IIOP is the standard protocol for communications running on the Internet or on an intranet within an enterprise.

Oracle Tuxedo CORBA has a native implementation of IIOP, ensuring high-performance, interoperable, distributed-object applications for the Internet, intranets, and enterprise computing environments. You can build integrated enterprise applications using multiple programming models. CORBA and Application-to- Transaction-Monitor-Interface (ATMI) applications can be developed with fully integrated transaction management, security, administration, and reliability capabilities.

The interoperability technology incorporated into Oracle Tuxedo CORBA provides for scalable connectivity between the CORBA and WebLogic Server environments. For information on interoperability see BEA Tuxedo Interoperability in the Oracle Tuxedo online documentation.

The following figure illustrates the Oracle Tuxedo CORBA environment.

Figure 1-1 Oracle Tuxedo CORBA



1.2 Features of the Oracle Tuxedo CORBA Environment

The CORBA environment in the Oracle Tuxedo product provides the following set of features:

- A C++ server-side ORB
- Client application options including:
  - CORBA C++ client
  - Third-party client ORBs
- A proven run-time infrastructure for hosting e-commerce transaction applications, including client connection concentrators, high-performance message routing and load balancing, and high-availability features.
- A Transaction Processing (TP) Framework for object state and transaction management in CORBA applications.
- A Management Information Base (MIB) that defines the key management attributes of CORBA applications. In addition, programming interfaces and scripting capabilities are available to access the MIBs.

- The CORBA Transaction Service (OTS) to ensure the integrity of your data even when transactions span multiple programming models, databases, and applications.
- A security service that handles authentication for principals that need to access resources in a CORBA object in the CORBA environment.
- The Secure Sockets Layer (SSL) protocol to encrypt client to server communication on the wire. SSL support includes IIOP connection pools.
- A Security Service Plug-In Interface (SPI) for CORBA that allows integration of third-party security plug-ins.
- A Notification Service that receives event posting messages, filters them, and distributes the messages to subscribers. The Notification Service provides two sets of interfaces: a CORBA-based interface and a simplified Oracle-proprietary interface.
- An implementation of the CosLifeCycle service.
- An implementation of CosNaming that allows Oracle Tuxedo CORBA server applications to advertise object references using logical names.
- An interface repository that stores meta information about Oracle Tuxedo CORBA objects. Meta information includes information about modules, interfaces, operations, attributes, and exceptions.
- Dynamic Invocation Interface (DII) support. DII allows Oracle Tuxedo CORBA client applications to create requests dynamically for objects that were not defined at compile time.

The remainder of this manual describes the programming environment for Oracle Tuxedo CORBA and the development process for CORBA applications.

2

The Oracle Tuxedo CORBA Programming Environment

> **Note:**
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> Technical support for third party CORBA Java ORBs should be provided by their respective vendors. Oracle Tuxedo does not provide any technical support or documentation for third party CORBA Java ORBs.

This topic includes the following sections:

2.1 Overview of the Oracle Tuxedo CORBA Programming Features

Oracle Tuxedo offers a robust CORBA programming environment that simplifies the development and management of distributed objects. The following topics describe the features of the programming environment:

2.1.1 IDL Compilers

The Oracle Tuxedo CORBA programming environment supplies Interface Definition Language (IDL) compilers to facilitate the development of CORBA objects:

- `idl`—compiles the OMG IDL file and generates client stub and server skeleton files required for interface definitions being implemented in C++.

For a description of how to use the IDL compiler, see Overview of the Development Process for Oracle Tuxedo CORBA Applications. For a description of the `idl` command, see the Oracle® Tuxedo Command Reference in the Oracle Tuxedo online documentation.

2.1.2 Development Commands

The following table lists the commands that the Oracle Tuxedo CORBA programming environment provides for developing CORBA applications and managing the Interface Repository.

Table 2-1 Oracle Tuxedo CORBA Development Commands

Development Command	Description
`buildobjclient`	Constructs a C++ client application.
`buildobjserver`	Constructs a C++ server application.
`genicf`	Generates an Implementation Configuration File (ICF). The ICF file defines activation and transaction policies for C++ server applications.
`id12ir`	Creates the Interface Repository and loads interface definitions into it.
`ir2idl`	Shows the content of the Interface Repository.
`irdel`	Deletes the specified object from the Interface Repository.

For a description of how to use the development commands to develop client and server applications, see Overview of the Development Process for Oracle Tuxedo CORBA Applications.

For a description of the development commands, see the Oracle® Tuxedo Command Reference in the Oracle Tuxedo online documentation.

2.1.3 Administration Tools

The Oracle Tuxedo CORBA programming environment provides a complete set of tools for administering your CORBA applications. You can manage Oracle Tuxedo CORBA applications through commands, by including administration utilities in a script.

You can use the commands listed in the following table to perform administration tasks for your CORBA application.

Table 2-2 Administration Commands

Administration Command	Description
`tmadmin`	Displays information about current configuration parameters.
`tmboot`	Activates the Oracle Tuxedo CORBA application referenced in the specified configuration file. Depending on the options used, the entire application or parts of the application are started.
`tmconfig`	Dynamically updates and retrieves information about the configuration of a Oracle Tuxedo CORBA application.
`tmloadcf`	Parses the configuration file and loads the binary version of the configuration file.
`tmshutdown`	Shuts down a set of specified server applications, or removes interfaces from a configuration file.
`tmunloadcf`	Unloads the configuration file.

A set of utilities called the AdminAPI is provided for directly accessing and manipulating system settings in the Management Information Bases (MIBs) for the Oracle Tuxedo product. The advantage of the AdminAPI is that it can be used to automate administrative tasks, such

as monitoring log files and dynamically reconfiguring an application, thus eliminating the need for manual intervention.

For information about the Administration commands, see File Formats, Data Descriptions, MIBs, and System Processes Reference in the Oracle Tuxedo online documentation.

For information about the AdminAPI, see Oracle Tuxedo Application Configuration Guide in the Oracle Tuxedo online documentation.

2.2 Oracle Tuxedo CORBA Object Services

The Oracle Tuxedo product includes a set of environmental objects that provide object services to CORBA client applications in a Oracle Tuxedo domain. You access the environmental objects through a bootstrapping process that accesses the services in a particular Oracle Tuxedo domain.

Oracle Tuxedo CORBA provides the following services:

- Object Life Cycle service
  The Object Life Cycle service is provided through the FactoryFinder environmental object. The FactoryFinder object is a CORBA object that can be used to locate a factory, which in turn can create object references for CORBA objects. Factories and FactoryFinder objects are implementations of the CORBA Services Life Cycle Service. Oracle Tuxedo CORBA applications use the Object Life Cycle service to find object references.

  For information about using the Object Life Cycle Service, see How Oracle Tuxedo CORBA Client and Server Applications Interact.

- Security service
  The Security service is accessed through either the SecurityCurrent environmental object or the PrincipalAuthenticator object. The SecurityCurrent and PrincipalAuthenticator objects are used to authenticate a client application into a Oracle Tuxedo domain with the proper security. The Oracle Tuxedo software provides an implementation of the CORBA Services Security Service.

  For information about using security, see Using Security in CORBA Applications in the Oracle Tuxedo online documentation.

- Transaction service
  The Transaction service is accessed through either the TransactionCurrent environmental object or the TransactionFactory object. The TransactionCurrent and TransactionFactory objects allow a client application to participate in a transaction. The Oracle Tuxedo software provides an implementation of the CORBA Services Object Transaction Service (OTS).

  For information about using transactions, see Using CORBA Transactions in the Oracle Tuxedo online documentation.

- Interface Repository service
  The Interface Repository service is accessed through the InterfaceRepository object. The InterfaceRepository object is a CORBA object that contains interface definitions for all the available CORBA interfaces and the factories used to create object references to the CORBA interfaces. The InterfaceRepository object is used with client applications that use DII.

  For information about using DII, see Creating CORBA Client Applications

Oracle Tuxedo CORBA provides environmental objects for the following programming environments:

- C++

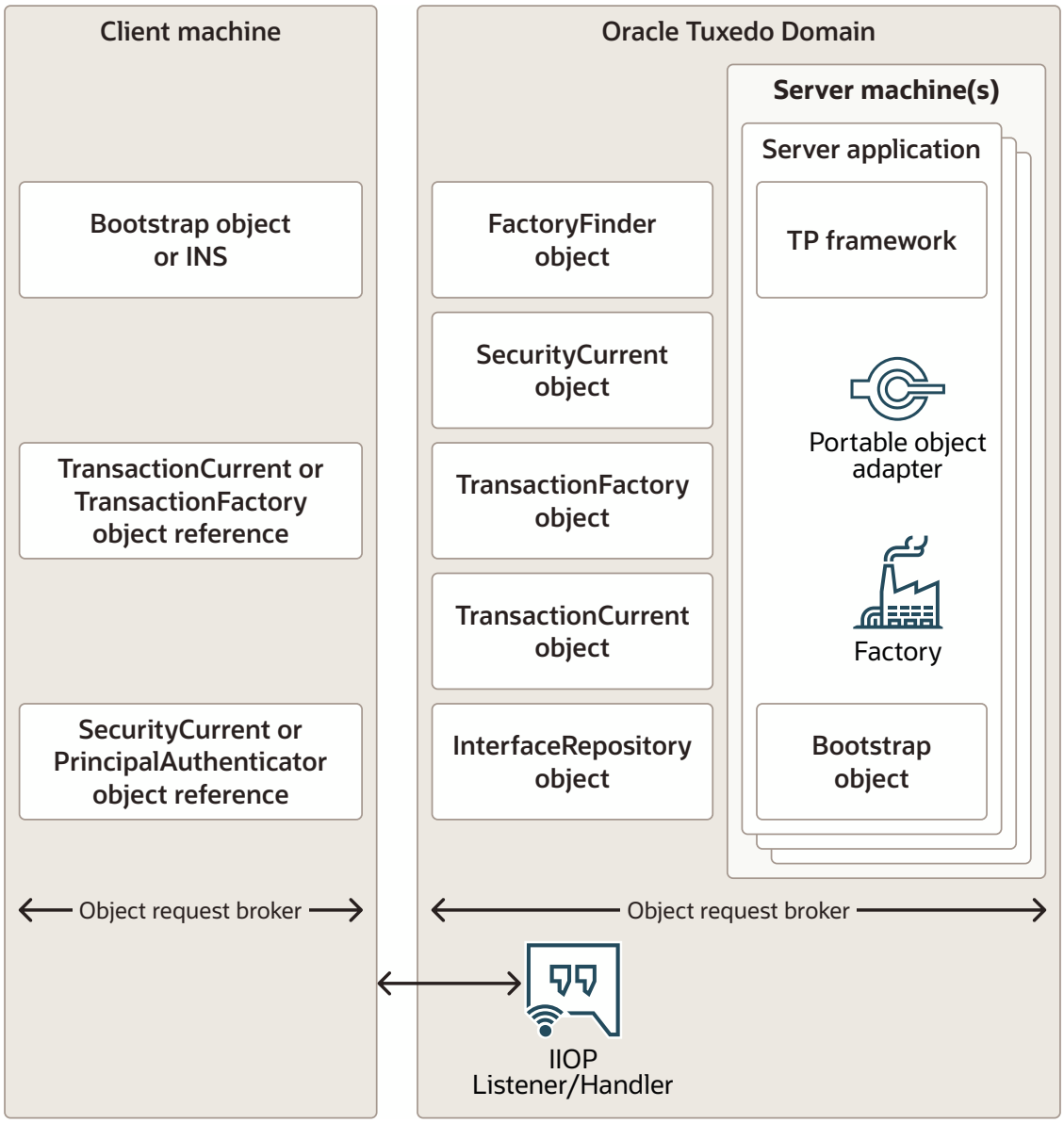
Oracle Tuxedo CORBA also supports the use of the OMG CORBA Interoperable Naming Service (INS) by third-party clients, to obtain initial object references.

2.3 Oracle Tuxedo CORBA Architectural Components

This section provides an introduction to the following architectural components of the Oracle Tuxedo CORBA programming environment.

The following figure illustrates the components in a Oracle Tuxedo CORBA application.

Figure 2-1 Components in a Oracle Tuxedo CORBA Application



- Bootstrapping the Oracle Tuxedo Domain
- IIOP Listener/Handler

- ORB
- TP Framework

2.3.1 Bootstrapping the Oracle Tuxedo Domain

A domain is a way of grouping objects and services together as a management entity. A Oracle Tuxedo domain has at least one IIOP Listener/Handler and is identified by a name. One client application can connect to multiple Oracle Tuxedo domains using different Bootstrap objects.

Bootstrapping the Oracle Tuxedo domain establishes communication between a client application and the domain. There are two mechanisms available for bootstrapping, the Oracle mechanism and the CORBA Interoperable Naming Service (INS) bootstrapping mechanism specified by the OMG. Use the Oracle mechanism if you are using Oracle CORBA client software. Use the CORBA INS mechanism if you are using a client ORB from another vendor. For more information about bootstrapping the Oracle Tuxedo domain, see the *CORBA Programming Reference* in the Oracle Tuxedo online documentation.

One of the first things that client applications do after startup is create a Bootstrap object by supplying the host and port of the IIOP Listener/Handler using one of the following URL address formats:

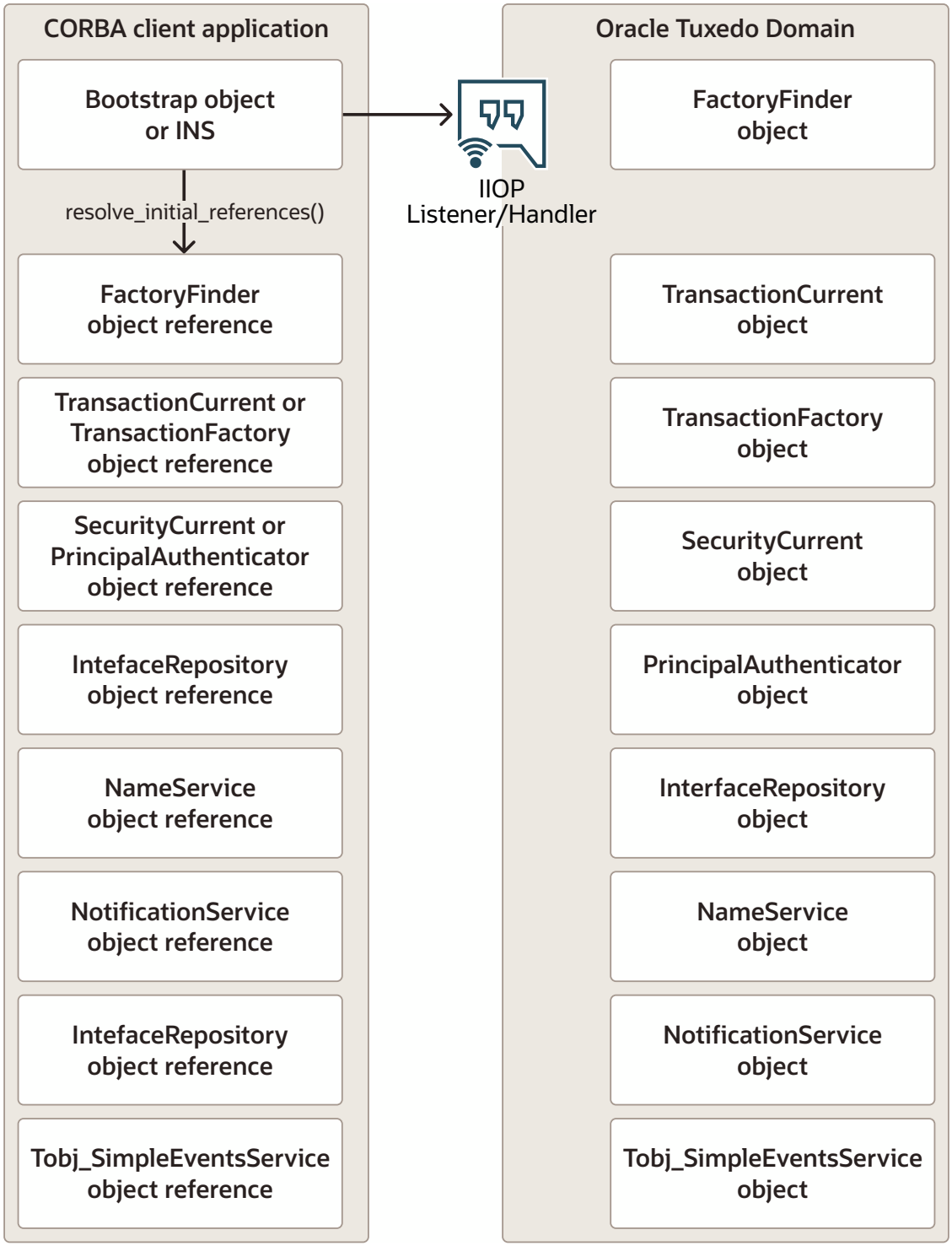
- `//host:port`
- `corbaloc://host:port`
- `corbalocs://host:port`

For more information about the Bootstrap URL address formats, see *Using Security in CORBA Applications* in the Oracle Tuxedo online documentation.

The client application then uses the Bootstrap object or the INS bootstrapping mechanism to obtain references to the objects in a Oracle Tuxedo domain. Once the Bootstrap object is instantiated, the `resolve_initial_references()` method is invoked by the client application, passing in a `string id`, to obtain a reference to the objects in the Oracle Tuxedo domain that provide CORBA services.

The following figure illustrates how the Bootstrap object or INS mechanism operates in a Oracle Tuxedo domain.

Figure 2-2 How the Bootstrap Object or INS Operates



2.3.2 IIOP Listener/Handler

The IIOP Listener/Handler is a process that receives the CORBA client request, which is sent using IIOP, and delivers that request to the appropriate CORBA server application. The IIOP Listener/Handler serves as a communication concentrator, providing a critical scalability

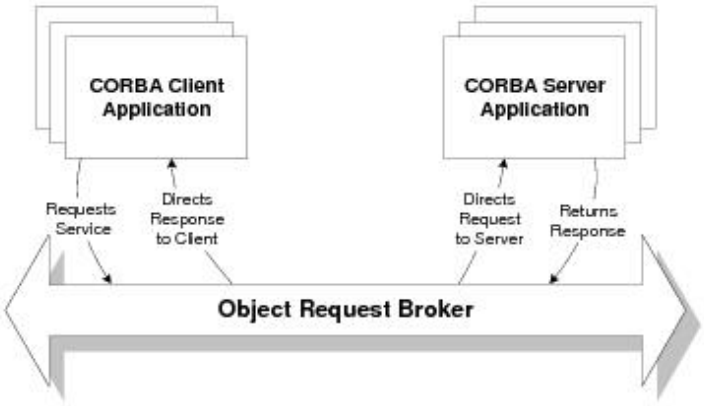
feature. The IIOP Listener/Handler removes from the CORBA server application the burden of maintaining client connections. For information about configuring the IIOP Listener/Handler, see Oracle® Tuxedo Application Configuration Guide and the description of the ISL command in the Oracle® Tuxedo Command Reference in the Oracle Tuxedo online documentation.

2.3.3 ORB

The ORB serves as an intermediary for requests that CORBA client applications send to CORBA server applications, so that these applications do not need to contain information about each other. The ORB is responsible for all the mechanisms required to find the implementation that can satisfy the request, to prepare an object's implementation to receive the request, and to communicate the data that makes up the request. The Oracle Tuxedo CORBA product includes a C++ client/server ORB.

The following figure shows the relationship between an ORB, a CORBA client application, and a CORBA server application.

Figure 2-3 The ORB in a CORBA Client/Server Environment



When the client application uses IIOP to send a request to the Oracle Tuxedo domain, the ORB performs the following functions:

- Validates each request and its arguments to ensure that the client application supplied all the required arguments.
- Manages the mechanisms required to find the CORBA object that can satisfy the request from the CORBA client application. To do this, the ORB interacts with the Portable Object Adapter (POA). The POA prepares an object's implementation to receive the request and communicates the data in the request.
- Marshals data. The ORB on the client machine writes the data associated with the request into a standard form. The ORB receives this data and converts it into the format appropriate for the machine on which the server application is running. When the server application sends data back to the client application, the ORB marshals the data back into its standard form and sends it back to the ORB on the client machine.

2.3.4 TP Framework

The TP Framework provides a programming model that achieves high levels of performance while shielding the application programmer from the complexities of the CORBA interfaces.

The TP Framework supports the rapid construction of CORBA applications, which makes it easier for application programmers to adhere to design patterns associated with successful TP applications.

The TP Framework interacts with the Portable Object Adapter (POA) and the CORBA application, thus eliminating the need for direct POA calls in an application. In addition, the TP Framework integrates transactions and state management into the Oracle Tuxedo CORBA application.

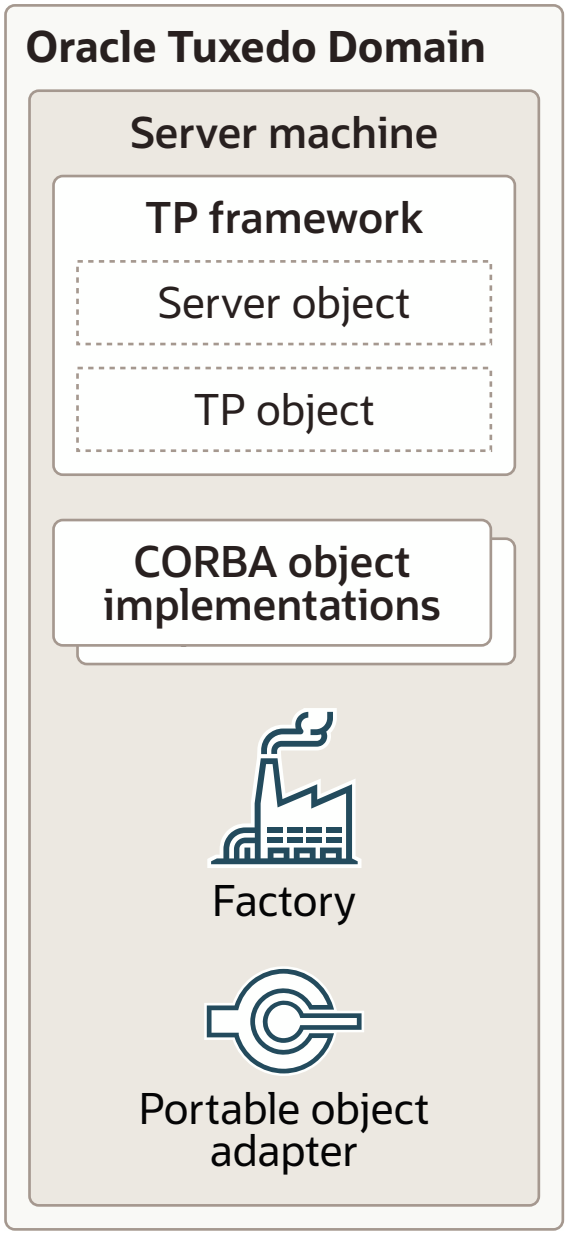
The application programmer uses an application programming interface (API) that automates many of the functions required in a standard CORBA application. The application programmer is responsible only for writing the business logic of the CORBA application and overriding default actions provided by the TP Framework.

The TP Framework API provides routines that perform the following functions required by a CORBA application:

- Initializing the CORBA server application and executing startup and shutdown routines
- Creating object references
- Registering and unregistering object factories
- Managing objects and object state
- Tying the CORBA server application to Oracle Tuxedo CORBA system resources
- Getting and initializing the ORB
- Performing object housekeeping

The TP Framework ensures that the execution of a client request takes place in a coordinated, predictable manner. The TP Framework calls the objects and services available in the Oracle Tuxedo application at the appropriate time, in the correct sequence. In addition, the TP Framework maximizes the reuse of system resources by objects. The following figure illustrates the TP Framework.

Figure 2-4 The TP Framework



The TP Framework is not a single object, but is rather a collection of objects that work together to manage the CORBA objects that contain and implement the data and business logic in your CORBA application.

One of the TP Framework objects is the Server object. The Server object is a user-written programming entity that implements operations that perform tasks such as initializing and releasing the server application. For server applications the TP Framework instantiates the CORBA objects needed to satisfy a client request.

If a client request arrives requiring an object that is not currently active and in memory in the server application, the TP Framework coordinates all the operations that are required to instantiate the object. This includes coordinating with the ORB and the POA to get the client request to the appropriate object implementation code.

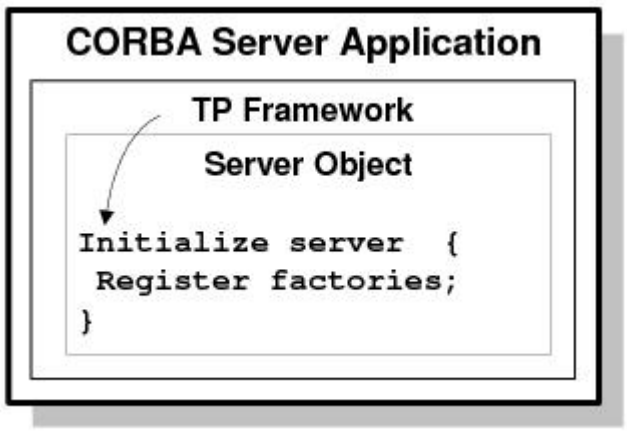
2.4 How Oracle Tuxedo CORBA Client and Server Applications Interact

The interaction between Oracle Tuxedo CORBA client and server applications includes the following steps:

2.4.1 Step 1: The CORBA Server Application Is Initialized

The system administrator enters the `tmboot` command on a machine in the Oracle Tuxedo domain to start the Oracle Tuxedo CORBA server application. The TP Framework invokes the `initialize()` operation in the `Server` object to initialize the server application.

Figure 2-5 CORBA Server Application



During the initialization process, the Server object does the following:

1. Uses the Bootstrap object or INS to obtain a reference to the FactoryFinder object.
2. Typically registers any factories with the FactoryFinder object.
3. Optionally gets an object reference to the ORB.
4. Performs any process-wide initialization.

2.4.2 Step 2: The CORBA Client Application Is Initialized

During initialization, the CORBA client application obtains initial references to the objects available in the Oracle Tuxedo domain.

Figure 2-6 CORBA Client Application

The Bootstrap object returns references to the FactoryFinder, SecurityCurrent, TransactionCurrent, NameService, and InterfaceRepository objects in the Oracle Tuxedo domain.

2.4.3 Step 3: The CORBA Client Application Authenticates Itself to the Oracle Tuxedo Domain

If the Oracle Tuxedo domain has a security model in effect, the CORBA client application needs to authenticate itself to the Oracle Tuxedo domain before it can invoke any operations in the CORBA server application. To authenticate itself to the Oracle Tuxedo domain using authentication, the CORBA client application completes these steps:

1. Uses the Bootstrap object to obtain a reference to the SecurityCurrent object.
2. Invokes the `logon()` operation of the PrincipalAuthenticator object, which is retrieved from the SecurityCurrent object.

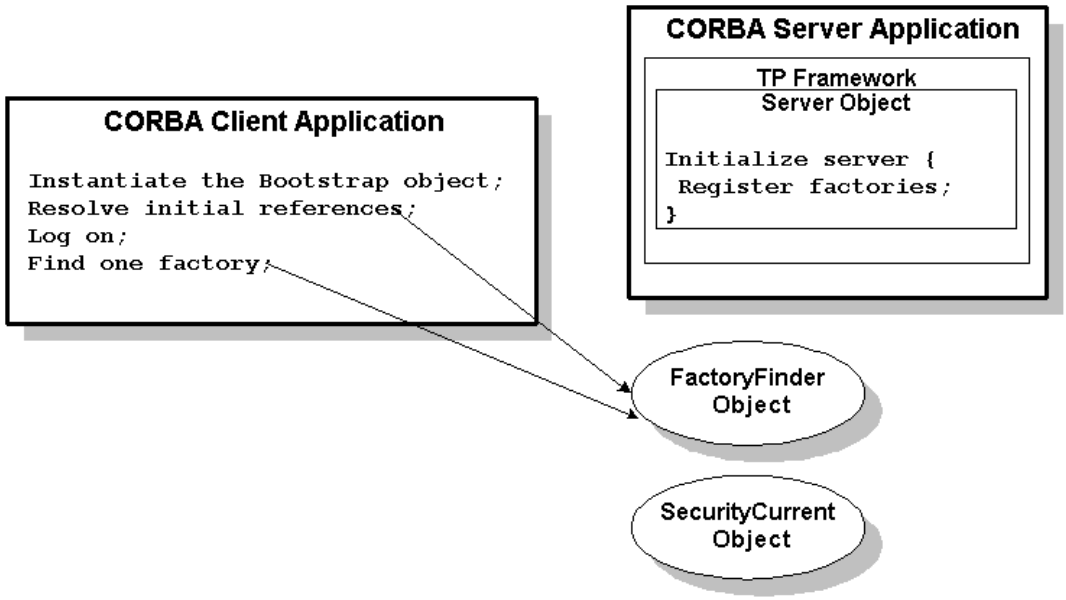
> **Note:**
>
> For information about using certificate based authentication, see Using Security in CORBA Applications in the Oracle Tuxedo online documentation.

2.4.4 Step 4: The CORBA Client Application Obtains a Reference to the CORBA Object Needed to Execute Its Business Logic

The CORBA client application needs to perform the following steps:

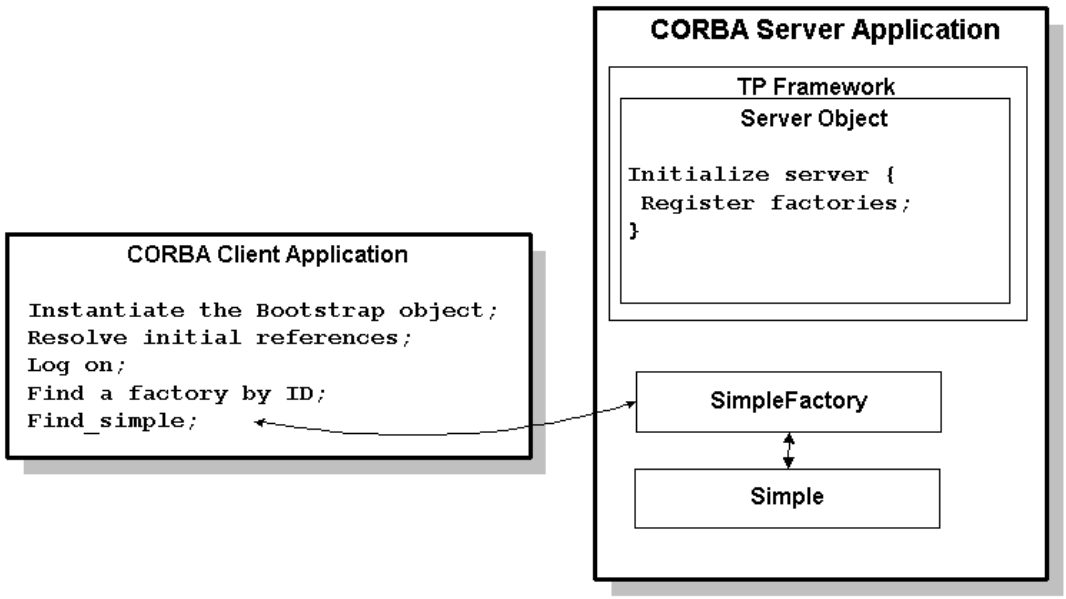
1. Obtain a reference to the factory for the object it requires.
   For example, the client application needs a reference to the SimpleFactory object. The client application obtains this factory reference from the FactoryFinder object, shown in the following figure.
2. Invoke the SimpleFactory object to get a reference to the `Simple` object.
   If the SimpleFactory object is not active, the TP Framework instantiates the SimpleFactory object by invoking the `Server::create_servant` method on the Server object, shown in the following figure.

Figure 2-7 CORBA Server Application



3. The TP Framework invokes the `activate_object()` and `find_simple()` operations on the SimpleFactory object to get a reference to the Simple object, shown in the following figure.

Figure 2-8 Operations on the SimpleFactory object



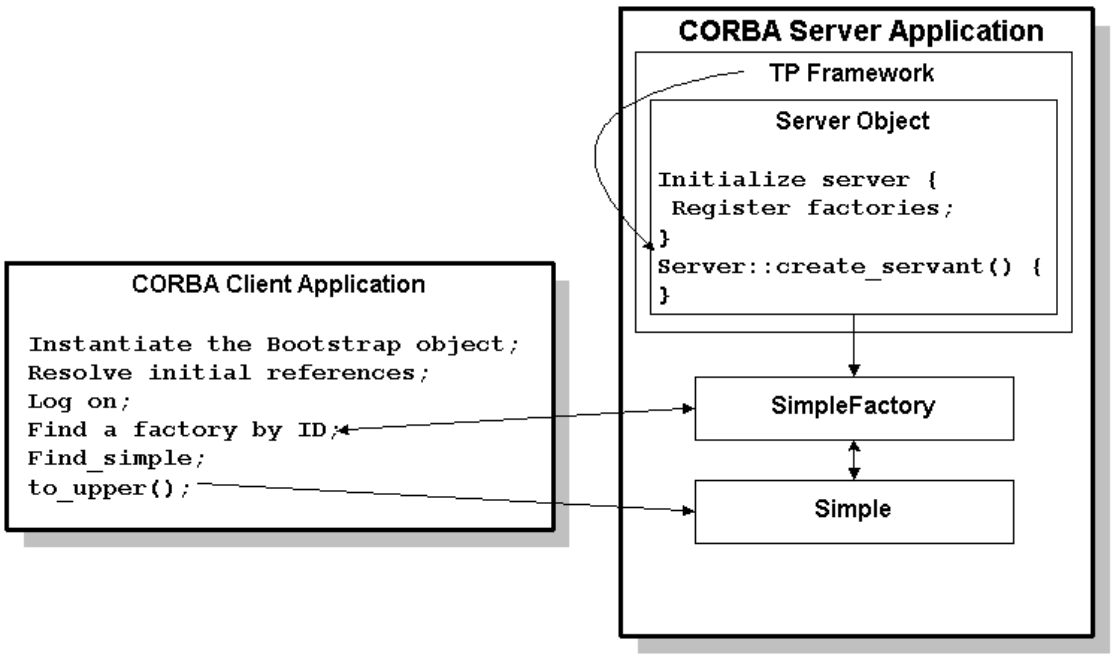
The SimpleFactory object then returns the object reference to the `Simple` object to the client application.

> **Note:**
>
> Because the TP Framework activates objects by default, the Simpapp sample application does not explicitly use the `activate_object()` operation for the SimpleFactory object.

2.4.5 Step 5: The CORBA Client Application Invokes an Operation on the CORBA Object

Using the reference to the CORBA object that the factory has returned to the client application, the client application invokes an operation on the object. For example, now that the client application has an object reference to the Simple object, the client application can invoke the `to_upper()` operation on it. The instance of the Simple object required for the client request is created as shown in the following figure.

Figure 2-9 Simple object required for the client request



3

Developing Oracle Tuxedo CORBA Applications

For an in-depth discussion of creating Oracle Tuxedo CORBA client and server applications, see the following in the Oracle Tuxedo online documentation:

- *Creating CORBA Client Applications*
- *Creating CORBA Server Applications*

> **Note:**
>
> The Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB were deprecated in Tuxedo 8.1 and are no longer supported. All Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB text references, associated code samples, should only be used to help implement/run third party Java ORB libraries, and for programmer reference only.
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This topic includes the following sections:

3.1 Overview of the Development Process for Oracle Tuxedo CORBA Applications

The following table outlines the development process for Oracle Tuxedo CORBA applications.

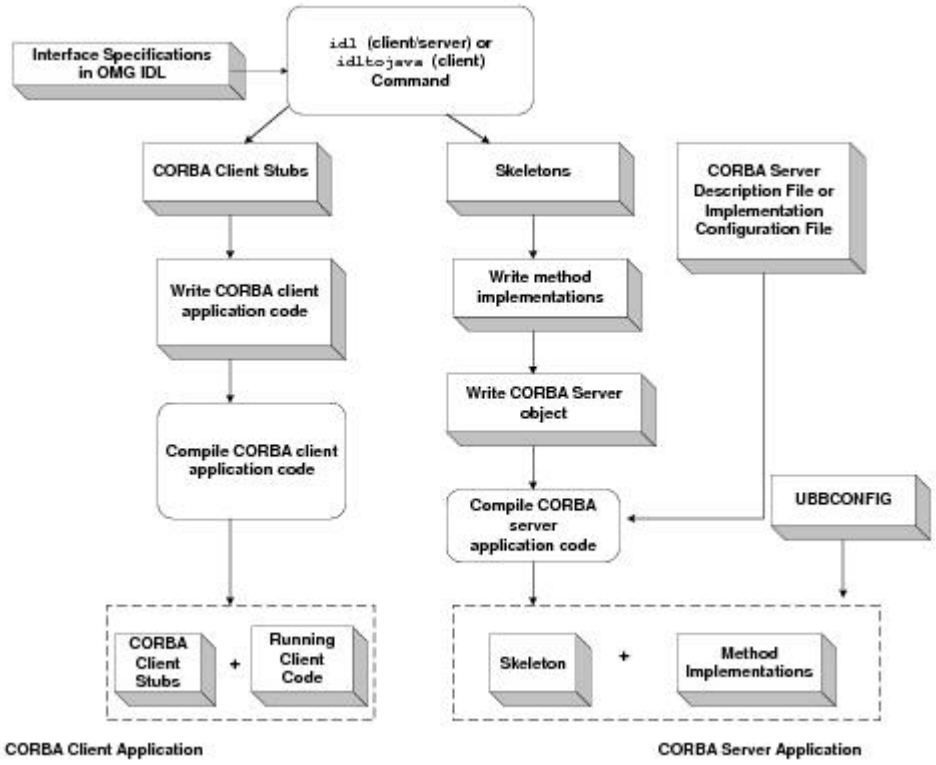
Table 3-1 Development Process for Oracle Tuxedo CORBA Applications

Step	Description
1	Write the Object Management Group (OMG) Interface Definition Language (IDL) code for each CORBA interface you want to use in your Oracle Tuxedo application.
2	Generate the CORBA client stubs and the skeletons.
3	Write the CORBA server application.
4	Write the CORBA client application.
5	Create an XA resource manager.
6	Create a configuration file.
7	Create a TUXCONFIG file.
8	Compile the CORBA server application.
9	Compile the CORBA client application.
10	Start the Oracle Tuxedo CORBA application.

The steps in the development process are described in the following sections.

The following figure illustrates the process for developing Oracle Tuxedo CORBA applications.

Figure 3-1 Development Process for Oracle Tuxedo CORBA Applications



3.2 The Simpapp Sample Application

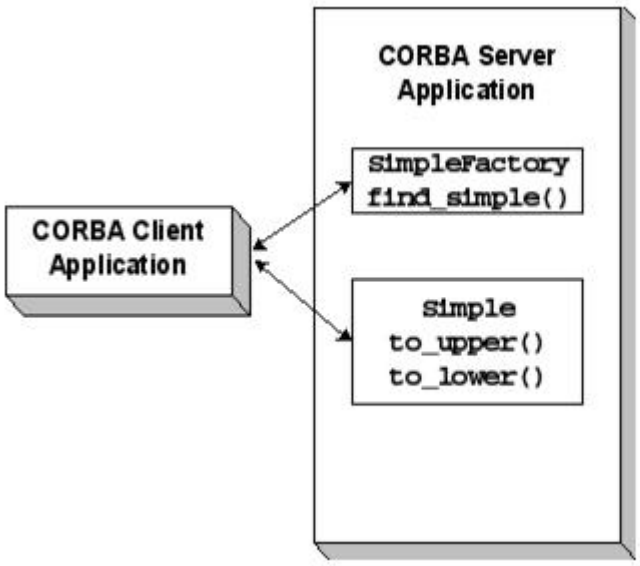
Throughout this topic, the Simpapp sample application is used to demonstrate the development steps.

The CORBA server application in the Simpapp sample application provides an implementation of a CORBA object that has the following two methods:

- The `upper` method accepts a string from the CORBA client application and converts the string to uppercase letters.
- The `lower` method accepts a string from the CORBA client application and converts the string to lowercase letters.

The following figure illustrates how the Simpapp sample application works.

Figure 3-2 Simpapp Sample Application



The source files for the Simpapp sample application are located in the `$TUXDIR\samples\corba\simpapp` directory of the Oracle Tuxedo software. Instructions for building and running the Simpapp sample applications are in the `Readme.txt` file in the same directory.

> **Note:**
>
> The Simpapp sample applications demonstrate building CORBA C++ client and server applications.

Oracle Tuxedo offers a suite of sample applications that demonstrate and aid in the development of Oracle Tuxedo CORBA applications. For an overview of the available sample applications, see Samples in the Oracle Tuxedo online documentation.

3.3 Step 1: Write the OMG IDL Code

The first step in writing a Oracle Tuxedo CORBA application is to specify all of the CORBA interfaces and their methods using the Object Management Group (OMG) Interface Definition Language (IDL). An interface definition written in OMG IDL completely defines the CORBA interface and fully specifies each operation's arguments. OMG IDL is a purely declarative language. This means that it contains no implementation details. Operations specified in OMG IDL can be written in and invoked from any language that provides CORBA bindings.

The Simpapp sample application implements the CORBA interfaces listed in the following table.

Table 3-2 CORBA Interfaces for the Simpapp Sample Application

Interface	Description	Operation
`SimpleFactory`	Creates object references to the Simple object	`find_simple ()`
`Simple`	Converts the case of a string	`to_upper () to_lower ()`

Here is a code snippet that illustrates the `simple.idl` file that defines the CORBA interfaces in the Simpapp sample application.

```
#pragma prefix "beasys.com"
interface Simple
{
  // Convert a string to lower case (return a new string)
  string to_lower (in string val);
  // Convert a string to upper case (in place)
  void to_upper (inout string val);
};
interface SimpleFactory
{
  Simple find_simple ();
};
```

3.4 Step 2: Generate CORBA client Stubs and Skeletons

The interface specification defined in OMG IDL is used by the IDL compiler to generate CORBA client stubs for the CORBA client application, and skeletons for the CORBA server application. The CORBA client stubs are used by the CORBA client application for all operation invocations. You use the skeleton, along with the code you write, to create the CORBA server application that implements the CORBA objects.

During the development process, use one of the following commands to compile the OMG IDL file and produce CORBA client stubs and skeletons for Oracle Tuxedo CORBA client and server applications:

- If you are creating CORBA C++ client and server applications, use the `idl` command. For a description of the `idl` command, see the *Oracle Tuxedo Command Reference* in the Oracle Tuxedo online documentation.

The following table lists the files that are created by the `idl` command.

Table 3-3 Files Created by the idl Command

File	Default Name	Description
CORBA client stub file	*application_c*.cpp	Contains generated code for sending a request.
CORBA client stub header file	*application_c*.h	Contains class definitions for each interface and type specified in the OMG IDL file.
Skeleton file	*application_s*.cpp	Contains skeletons for each interface specified in the OMG IDL file. During run time, the skeleton maps CORBA client requests to the appropriate operation in the CORBA server application.
Skeleton header file	*application_s*.h	Contains the skeleton class definitions.
Implementation file	*application_i*.cpp	Contains signatures for the methods that implement the operations on the interfaces specified in the OMG IDL file.
Implementation header file	*application_i*.h	Contains the initial class definitions for each interface specified in the OMG IDL file.

3.5 Step 3: Write the CORBA Server Application

The Oracle Tuxedo software supports CORBA C++ server applications. The steps for creating CORBA server applications are:

> **Note:**
>
> Oracle Tuxedo uses the new style of std C++ header files on Linux/HP-UX/Solaris, and uses the older style of files on AIX. You can check the"`OBB_ANSI_CPP`" macro to decide which type of header to use.
> If "`OBB_ANSI_CPP`" is defined, the standard C++ headers are included.
>
> If "`OBB_ANSI_CPP`" is undefined, the old C headers are included.

- Writing the Methods That Implement the Operations for Each Interface
- Creating the CORBA server Object
- Defining an Object's Activation Policies
- Creating and Registering a Factory
- Releasing the CORBA Server Application

3.5.1 Writing the Methods That Implement the Operations for Each Interface

After you compile the OMG IDL file, you require to write methods that implement the operations for each interface in the file. An implementation file contains the following:

- Method declarations for each operation specified in the OMG IDL file
- Your application's business logic
- Constructors for each interface implementation (implementing these is optional)
- The `activate_object()` and `deactivate_object()` methods (optional)
  Within the `activate_object`() and `deactivate_object()` methods, you write code that performs any particular steps related to activating or deactivating the object. For more information, see Creating CORBA Server Applications in the Oracle Tuxedo online documentation.

You can write the implementation file manually. The `idl` command provides an option for generating a template for implementation files.

The following code snippet illustrates the C++ implementation of the `Simple` and `SimpleFactory` interfaces in the Simpapp sample application.

```
// Implementation of the Simple_i::to_lower method which converts
// a string to lower case.

char * Simple_i::to_lower(const char * value) {
  CORBA::String_var var_lower = CORBA::string_dup(value);
  for (char * ptr = var_lower; ptr && * ptr; ptr++) {
    * ptr = tolower( * ptr);
  }
  return var_lower._retn();
}
// Implementation of the Simple_i::to_upper method which converts
// a string to upper case.

void Simple_i::to_upper(char * & value1) {
  CORBA::String_var var_upper = value1;
  var_upper = CORBA::string_dup(var_upper.in());
  for (char * ptr = var_upper; ptr && * ptr; ptr++) {
    * ptr = toupper( * ptr);
  }
  value = var_upper._retn();
}
// Implementation of the SimpleFactory_i::find_simple method which
// creates an object reference to a Simple object.

Simple_ptr SimpleFactory_i::find_simple() {
  CORBA::Object_var var_simple_oref =
    TP::create_object_reference(
      _tc_Simple - > id(),
      "simple",
      CORBA::NVList::_nil()
    );
}
```

3.5.2 Creating the CORBA server Object

The Server object performs the following tasks:

- Initializes the CORBA server application, including registering factories, allocating resources required by the CORBA server application, and, if necessary, opening an XA resource manager.
- Performs CORBA server application shutdown and cleanup procedures.
- Instantiates CORBA objects required to satisfy CORBA client requests.

In CORBA server applications, the Server object is already instantiated and a header file for the Server object is available. You implement methods that initialize and release the server application, and, if desired, create servant objects.

The following code snippet includes the C++ code from the Simpapp sample application for the Server object.

```
static CORBA::Object_var static_var_factory_reference;
// Method to start up the server
CORBA::Boolean
Server::initialize (int argc, char *argv[])
{
  // Create the Factory Object Reference
  static_var_factory_reference = TP::create_object_reference (
      _tc_SimpleFactory->id (), "simple_factory", CORBA::NVList::_nil ());
  // Register the factory reference with the FactoryFinder
  TP::register_factory (static_var_factory_reference.in (),
                        _tc_SimpleFactory->id ());
  return CORBA_TRUE;
}
// Method to shutdown the server
void
Server::release ()
{
  // Unregister the factory.
  try
    {
      TP::unregister_factory (static_var_factory_reference.in (),
                              _tc_SimpleFactory->id ());
    }
  catch (...)
    {
      TP::userlog ("Couldn't unregister the SimpleFactory");
    }
}
// Method to create servants
Tobj_Servant
Server::create_servant (const char *interface_repository_id)
{
  if (!strcmp (interface_repository_id, _tc_SimpleFactory->id ()))
    {
      return new SimpleFactory_i ();
    }
  if (!strcmp (interface_repository_id, _tc_Simple->id ()))
    {
      return new Simple_i ();
    }
  return 0;
}
```

3.5.3 Defining an Object's Activation Policies

As part of CORBA server development, you determine what events cause an object to be activated and deactivated by assigning object activation policies.

For CORBA server applications, specify object activation policies in the Implementation Configuration File (ICF). A template ICF file is created by the `genicf` command.

> **Note:**
>
> You also define transaction policies in the ICF file. For information about using transactions in your Oracle Tuxedo CORBA application, see Using CORBA Transactions in the Oracle Tuxedo online documentation.

The Oracle Tuxedo software supports the activation policies listed in the following table.

Table 3-4 Activation Policies

Activation Policy	Description
`method`	Causes the object to be active only for the duration of the invocation on one of the object's operations. This is the default activation policy.
`transaction`	Causes the object to be activated when an operation is invoked on it. If the object is activated within the scope of a transaction, the object remains active until the transaction is either committed or rolled back.
`process`	Causes the object to be activated when an operation is invoked on it, and to be deactivated only when one of the following occurs: • The process in which the server application exists is shut down. • The method `TP::deactivateEnable()` (C++) has been invoked on the object.

The `Simple` interface in the Simpapp sample application is assigned the default activation policy of method. For more information about managing object state and defining object activation policies, see Creating CORBA Server Applications in the Oracle Tuxedo online documentation.

3.5.4 Creating and Registering a Factory

If your CORBA server application manages a factory that you want CORBA client applications to be able to locate easily, you require to write the code that registers that factory with the FactoryFinder object.

To write the code that registers a factory managed by your CORBA server application, you do the following:

1. Create an object reference to the factory.
   You include an invocation to the`create_object_reference()` method, specifying the Interface Repository ID of the factory's OMG IDL interface or the object ID (OID) in string format. In addition, you can specify routing criteria.

2. Register the factory with the Oracle Tuxedo domain.
   Use the `register_factory()` method to register the factory with the FactoryFinder object in the Oracle Tuxedo domain. The `register_factory()` method requires the object reference for the factory and a string identifier.

The following code snippet illustrates the code snippet from the Simpapp sample application that creates and registers a factory.

```
...
CORBA::Object_var v_reg_oref =
       TP:create_object_reference(
       _tc.SimpleFactory->id(),       //Factory Interface ID
       "simplefactory",               //Object ID
        CORBA::NVList::_nil()        //Routing Criteria
      );
      TP::register_factory(
       CORBA::Object_var v_reg_oref.in(),
       _tc_SimpleFactory->id(),
      );
...
```

In the above code snippet, notice the following:

- `tc.SimpleFactory->id()` specifies the SimpleFactory object's Interface Repository ID by extracting it from its typecode.
- `CORBA::NVList::_nil()` specifies that no routing criteria are used, with the result that an object reference created for the Simple object is routed to the same group as the SimpleFactory object that created the object reference.

3.5.5 Releasing the CORBA Server Application

You require to include code in your CORBA server application to perform a graceful shutdown of the CORBA server application. The `release()`method is provided for that purpose. Within the `release()` method, you may perform any application-specific cleanup tasks that are specific to the CORBA server application, such as:

- Unregistering object factories managed by the CORBA server application
- Deallocating resources
- Closing any databases
- Closing an XA resource manager

Once a CORBA server application receives a request to shut down, the CORBA server application can no longer receive requests from other remote objects. This has implications on the order in which CORBA server applications should be shut down, which is an administrative task. For example, do not shut down one server process if a second server process contains an invocation in its `release()` method to the first server process.

During server shutdown, you may want to unregister each of the server application's factories. The invocation of the `unregister_factory()` method should be one of the first actions in the `release()` implementation. The `unregister_factory()` method unregisters the server application's factories. This operation requires the following input arguments:

- The object reference for the factory

- A string identifier, based on the factory object's interface typecode, used to identify the Interface Repository ID of the object's OMG IDL interface

The following code snippet includes C++ code that releases a server application and unregisters the factories in the CORBA server application.

```
...
public void release() {
                TP::unregister_factory(
                        factory_reference.in(),
                        SimpleFactoryHelper - > id
                );
        }
        ...
```

3.6 Step 4: Write the CORBA Client Application

The Oracle Tuxedo software supports the following types of CORBA client applications:

- CORBA C++

The steps for creating CORBA client applications are as follows:

1. Initialize the ORB.
2. Use the Bootstrap object or the CORBA INS bootstrapping mechanism to establish communication with the Oracle Tuxedo domain.
3. Resolve initial references to the FactoryFinder environmental object.
4. Use a factory to get an object reference for the desired `CORBA` object.
5. Invoke methods on the CORBA object.

The CORBA client development steps are illustrated in the following listing which include code from the Simpapp sample application. In the Simpapp sample application, the CORBA client application uses a factory to get an object reference to the Simple object and then invokes the `to_upper()` and `to_lower()` methods on the Simple object.

Here is a code snippet that illustrates the CORBA Client Application from the Simpapp Sample Application.

```
int main(int argc, char * argv[]) {
        try {
                // Initialize the ORB
                CORBA::ORB_var var_orb = CORBA::ORB_init(argc, argv, "");
                // Create the Bootstrap object
                Tobj_Bootstrap bootstrap(var_orb.in(), "");
                // Use the Bootstrap object to find the FactoryFinder
                CORBA::Object_var var_factory_finder_oref =
                        bootstrap.resolve_initial_references("FactoryFinder");
                // Narrow the FactoryFinder
                Tobj::FactoryFinder_var var_factory_finder_reference =

Tobj::FactoryFinder::_narrow(var_factory_finder_oref.in());
                // Use the factory finder to find the Simple factory
                CORBA::Object_var var_simple_factory_oref =
                        var_factory_finder_reference - >
find_one_factory_by_id(
```

```
                                _tc_SimpleFactory - > id()
                        );
                // Narrow the Simple factory
                SimpleFactory_var var_simple_factory_reference =
                        SimpleFactory::_narrow(
                                var_simple_factory_oref.in());
                // Find the Simple object
                Simple_var var_simple =
                        var_simple_factory_reference - > find_simple();
                // Get a string from the user
                cout << "String?";
                char mixed[256];
                cin >> mixed;
                // Convert the string to upper case :
                CORBA::String_var var_upper = CORBA::string_dup(mixed);
                var_simple - > to_upper(var_upper.inout());
                cout << var_upper.in() << endl;
                // Convert the string to lower case
                CORBA::String_var var_lower = var_simple - > to_lower(mixed);
                cout << var_lower.in() << endl;
                return 0;
        }
}
```

3.7 Step 5: Create an XA Resource Manager

When using transactions in a Oracle Tuxedo CORBA application, you require to create a CORBA server process for the resource manager that interacts with a database on behalf of the Oracle Tuxedo CORBA application. The resource manager you use must conform to the X/OPEN XA specification and you require the following information about the resource manager:

- The name of the structure of type `xa_switch_t` that contains the name of the XA resource manager.
- Flags indicating the capabilities of the XA resource manager and function pointers for the actual XA functions.
- The name of the object files that provide the services of the XA interface.
- The commands required to open and close the XA resource manager. This information is specified in the `OPENINFO` and `CLOSEINFO` parameters in the `UBBCONFIG` configuration file.

When integrating a new XA resource manager into the Oracle Tuxedo system, the file `$TUXDIR/udataobj/RM` must be updated to include information about the XA resource manager. The information is used to include the correct libraries for the XA resource manager and to set up the interface between the transaction manager and the XA resource manager automatically and correctly. The format of this file is as follows:

rm_name : *rm_structure_name* : *library_names*

where *rm_name* is the name of the XA resource manager, *rm_structure_name* is the name of the `xa_switch_t` structure that defines the name of the XA resource manager, and *library_names* is the list of the object files for the XA resource manager. White space (tabs and/or spaces) is allowed before and after each of the values and may be embedded within the *library_names*. The colon (:) character may not be embedded within any of the values. Lines beginning with a pound sign (#) are treated as comments and are ignored.

Use the `buildtms` command to build a server process for the XA resource manager. The files that result from the `buildtms` command require to be installed in the `$TUXDIR/bin` directory.

For more information about the `buildtms` command, see the Oracle Tuxedo Command Reference in the Oracle Tuxedo online documentation.

3.8 Step 6: Create a Configuration File

Because the Oracle Tuxedo software offers great flexibility and many options to application designers and programmers, no two CORBA applications are alike. An application, for example, may be small and simple (a single client and server running on one machine) or complex enough to handle transactions among thousands of client and server applications. For this reason, for every Oracle Tuxedo CORBA application being managed, the system administrator must provide a configuration file that defines and manages the components (for example, domains, server applications, client applications, and interfaces) of that application.

When system administrators create a configuration file, they are describing the Oracle Tuxedo CORBA application using a set of parameters that the Oracle Tuxedo software interprets to create a runnable version of the application. During the setup phase of administration, the system administrator's job is to create a configuration file. The configuration file contains the sections listed in the following table.

Table 3-5 Sections in the Configuration File for Oracle Tuxedo CORBA Applications

Sections in the Configuration File	Description
`RESOURCES`	Defines defaults (for example, user access and the main administration machine) for the Oracle Tuxedo CORBA application.
`MACHINES`	Defines hardware-specific information about each machine running in the Oracle Tuxedo CORBA application.
`GROUPS`	Defines logical groupings of server applications or CORBA interfaces.
`SERVERS`	Defines the server application processes (for example, the Transaction Manager) used in the Oracle Tuxedo CORBA application.
`SERVICES`	Defines parameters for services provided by the Oracle Tuxedo application.
`INTERFACES`	Defines information about the CORBA interfaces in the Oracle Tuxedo CORBA application.
`ROUTING`	Defines routing criteria for the Oracle Tuxedo CORBA application.

The following code snippet depicts the configuration file for the Simpapp sample application.

```
*RESOURCES
       IPCKEY     55432
       DOMAINID   simpapp
       MASTER     SITE1
       MODEL      SHM
       LDBAL      N
*MACHINES
       "PCWIZ"
       LMID         = SITE1
       APPDIR       = "C:\TUXDIR\MY_SIM~1"
```

```
        TUXCONFIG    = "C:\TUXDIR\MY_SIM~1\results\tuxconfig"
        TUXDIR       = "C:\TUXDIR"
        MAXWSCLIENTS = 10
*GROUPS
        SYS_GRP
        LMID     = SITE1
        GRPNO    = 1
        APP_GRP
        LMID     = SITE1
        GRPNO    = 2
*SERVERS
        DEFAULT:
           RESTART = Y
           MAXGEN  = 5
        TMSYSEVT
           SRVGRP  = SYS_GRP
           SRVID   = 1
        TMFFNAME
           SRVGRP  = SYS_GRP
           SRVID   = 2
           CLOPT   = "-A -- -N -M"
        TMFFNAME
           SRVGRP = SYS_GRP
           SRVID  = 3
           CLOPT  = "-A -- -N"
        TMFFNAME
           SRVGRP = SYS_GRP
           SRVID  = 4
           CLOPT  = "-A -- -F"
      simple_server
           SRVGRP  = APP_GRP
           SRVID   = 1
           RESTART = N
      ISL
         SRVGRP   = SYS_GRP
         SRVID    = 5
         CLOPT    = "-A -- -n //PCWIZ:2468"
*SERVICES
```

3.9 Step 7: Create the TUXCONFIG File

There are two forms of the configuration file:

- An ASCII version of the file, created and modified with any editor. Throughout the Oracle Tuxedo documentation, the ASCII version of the configuration file is referred to as the `UBBCONFIG` file. You can choose any name for the configuration file.
- The `TUXCONFIG` file, a binary version of the `UBBCONFIG` file created using the `tmloadcf` command. When the `tmloadcf` command is executed, the environment variable `TUXCONFIG` must be set to the name and directory location of the `TUXCONFIG` file. The `tmloadcf` command converts the configuration file to binary form and writes it to the location specified in the command.

For more information about the `tmloadcf` command, see the Oracle Tuxedo Command Reference in the Oracle Tuxedo online documentation.

3.10 Step 8: Compile the CORBA Server Application

You use the `buildobjserver` command to compile and link C++ server applications. The `buildobjserver` command has the following format:

```
buildobjserver [-o servername] [options]
```

In the `buildobjserver` command syntax:

- `-o` *servername* represents the name of the server application to be generated by this command.
- *options* represents the command-line options to the `buildobjserver` command.

When you create a server application to support multithreading, you must specify the `-t` option on the `buildobjserver` command when you build the application. For complete information on creating a server application to support multithreading, see Creating CORBA Server Applications.

3.11 Step 9: Compile the CORBA Client Application

The final step in the development of the CORBA client application is to produce the executable client application. To do this, you require to compile the code and then link against the client stub.

When creating CORBA C++ client applications, use the `buildobjclient` command to construct a Oracle Tuxedo CORBA client application executable. The command combines the CORBA client stubs for interfaces that use static invocation, and the associated header files, with the standard Oracle Tuxedo libraries to form a CORBA client executable. For the syntax of the `buildobjclient` command, see the Oracle Tuxedo Command Reference in the Oracle Tuxedo online documentation.

3.12 Step 10: Start the Oracle Tuxedo CORBA Application

Use the `tmboot` command to start the server processes in your Oracle Tuxedo CORBA application. The CORBA application is usually booted from the machine designated as the `MASTER` in the `RESOURCES` section of the `UBBCONFIG` file.

For the `tmboot` command to find executables, the Oracle Tuxedo system processes must be located in the `$TUXDIR/bin` directory. Server applications should be in `APPDIR`, as specified in the configuration file.

When booting server applications, the `tmboot` command uses the `CLOPT`, `SEQUENCE`, `SRVGRP`, `SRVID`, and `MIN` parameters from the configuration file. Server applications are booted in the order in which they appear in the configuration file.

For more information about using the `tmboot` command, see File Formats, Data Descriptions, MIBs, and System Processes Reference in the Oracle Tuxedo online documentation.

3.13 Additional Oracle Tuxedo CORBA Sample Applications

Sample applications demonstrate the tasks involved in developing a Oracle Tuxedo CORBA application, and provide sample code that can be used by CORBA client and server

programmers to build their own Oracle Tuxedo CORBA application. Code from the sample applications are used throughout the information topics in the Oracle Tuxedo product to illustrate the development and administrative steps.

The following table describes the additional Oracle Tuxedo CORBA sample applications.

Table 3-6 The Oracle Tuxedo CORBA Sample Applications

Oracle Tuxedo CORBA Sample Application	Description
Simpapp	Provides a CORBA C++ client application and a C++ server application. The C++ server application contains two operations that manipulate strings received from the C++ client application.
Basic	Describes how to develop Oracle Tuxedo CORBA client and server applications and configure the Oracle Tuxedo application. Building C++ server applications and CORBA C++ applications, CORBA client applications are demonstrated.
	Demonstrates adding Oracle Tuxedo authentication to a Oracle Tuxedo CORBA application. For information about building and running the Security sample application, see Using Security in CORBA Applications in the Oracle Tuxedo online documentation.
	Adds transactional objects to the CORBA C++ server application and CORBA client applications in the Basic sample application. The Transactions sample application demonstrates how to use the Implementation Configuration File (ICF) to define transaction policies for CORBA objects. For information about building and running the Transactions sample application, see Using CORBA Transactions in the Oracle Tuxedo online documentation.
	Demonstrates how to wrap an existing Oracle Tuxedo ATMI application as a CORBA object.
	Demonstrates replicating server applications, creating stateless objects, and implementing factory-based routing in server applications.
	Implements the necessary development and administrative changes to the Simpapp sample application to support certificate authentication. For information about building and running the Secure Simpapp sample application, see *Using Security in CORBA Applications* in the Oracle Tuxedo online documentation.
	Demonstrates how to use joint CORBA client/server applications and callback objects to implement events in a Oracle Tuxedo CORBA application. The C++ version uses the Oracle Simple Events API. For information about building and running the Introductory Events sample application, see Using the CORBA Notification Service in the Oracle Tuxedo online documentation.
	Provides a more complex implementation of events in a Oracle Tuxedo CORBA application with transient and persistent subscriptions and data filtering. The C++ version uses the Advanced CosNotification API. For information about building and running the Advanced Events sample application, see *Using the CORBA Notification Service* in the Oracle Tuxedo online documentation.

4
Using Security

> **Note:**
>
> This chapter describes how to use authentication. For a complete description of all the security features available in the CORBA security environment and instructions for implementing the features, see *Using Security in CORBA Applications* in the Oracle Tuxedo online documentation. The Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB were deprecated in Tuxedo 8.1 and are no longer supported. All Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB text references, associated code samples, should only be used to help implement/run third party Java ORB libraries, and for programmer reference only.
> Technical support for third party CORBA Java ORBs should be provided by their respective vendors. Oracle Tuxedo does not provide any technical support or documentation for third party CORBA Java ORBs.

This topic includes the following sections:

4.1 Overview of the Security Service

The CORBA environment in the Oracle Tuxedo product offers a security model based on the CORBA Services Security Service. The Oracle Tuxedo CORBA security model implements the authentication portion of the CORBA Services Security Service.

In the CORBA environment security information is defined on a domain basis. The security level for the domain is defined in the configuration file. Client applications use the SecurityCurrent object to provide the necessary authentication information to log on to the Oracle Tuxedo domain.

The following levels of authentication are provided:

- `TOBJ_NOAUTH`
  No authentication is needed; however, the client application may still authenticate itself, and may specify a username and a client application name, but no password.
- `TOBJ_SYSAUTH`
  The client application must authenticate itself to the Oracle Tuxedo domain and must specify a username, client application name, and application password.
- `TOBJ_APPAUTH`
  In addition to the `TOBJ_SYSAUTH` information, the client application must provide application-specific information. If the default Oracle Tuxedo CORBA authentication service is used in

the application configuration, the client application must provide a user password; otherwise, the client application provides authentication data that is interpreted by the custom authentication service in the application.

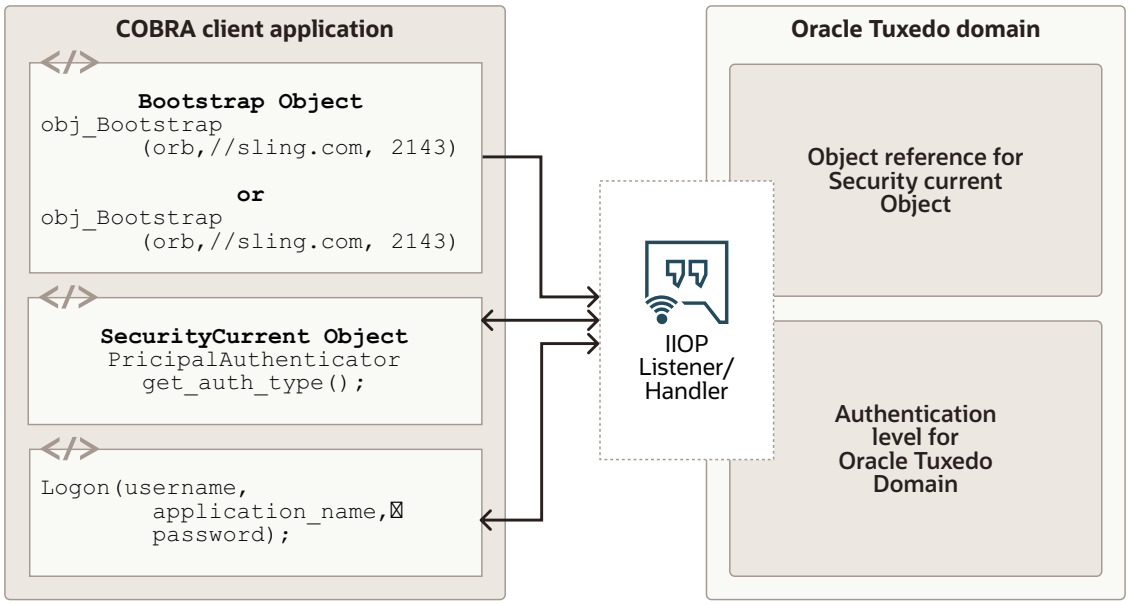
> **Note:**
>
> If a client application is not authenticated and the security level is `TOBJ_NOAUTH`, the IIOP Listener/Handler of the Oracle Tuxedo domain registers the client application with the username and client application name sent to the IIOP Listener/Handler.

In the Oracle Tuxedo CORBA security environment, only the PrincipalAuthenticator and Credentials properties on the SecurityCurrent object are supported. For a description of the `SecurityLevel1::Current` and `SecurityLevel2::Current` interfaces, see the CORBA Programming Reference in the Oracle Tuxedo online documentation.

4.2 How Security Works

The following figure illustrates how CORBA security works in a Oracle Tuxedo domain.

Figure 4-1 How CORBA Security Works on Oracle Tuxedo Domain



The steps are as follows:

1. The client application uses the Bootstrap object to return an object reference to the SecurityCurrent object for the Oracle Tuxedo domain.
2. The client application obtains the PrincipalAuthenticator.
3. The client application uses the `Tobj::PrincipalAuthenticator::get_auth_type()` method to get the authentication level for the Oracle Tuxedo domain.
4. The proper authentication level is returned to the client application.

5. The client application uses the `Tobj::PrincipalAuthenticator::logon()` method to log on to the Oracle Tuxedo domain with the proper authentication information.

> **Note:**
>
> Oracle Tuxedo CORBA also supports the use of the CORBA Interoperable Naming Service (INS) to obtain an initial object reference for the Security Service. For information on the INS bootstrapping mechanism, see the CORBA Programming Reference.

4.3 The Security Sample Application

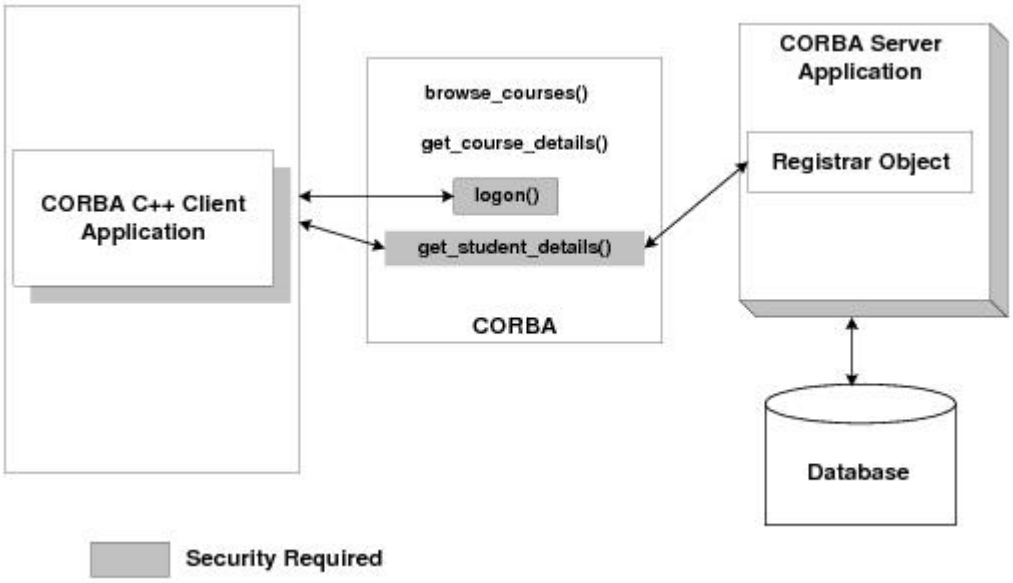
The Security sample application demonstrates how to use password authentication. The Security sample application requires that each student using the application has an ID and a password. The Security sample application works in the following manner:

- The client application has a `logon()` operation. This operation invokes operations on the PrincipalAuthenticator object, which is obtained as part of the process of logging on to access the domain.
- The server application implements a `get_student_details()` operation on the `Registrar` object to return information about a student. After the user is authenticated, logon is complete and the `get_student_details()` operation accesses the student information in the database to obtain the student information needed by the client logon operation.
- The database in the Security sample application contains course and student information.

> **Note:**
>
> Certificate authentication is illustrated in the Secure Simpapp sample application.

The following figure illustrates the Security sample application.

Figure 4-2 Security Sample Application



The source files for the Security sample application are located in the `\samples\corba\university` directory in the Oracle Tuxedo software. For information about building and running the Security sample application, see Using Security in CORBA Applications in the Oracle Tuxedo online documentation.

4.4 Development Steps

The following table lists the development steps for writing a Oracle Tuxedo CORBA application that employs authentication security.

Table 4-1 Development Steps for Oracle Tuxedo CORBA Applications That Have Security

Step	Description
1	Define the security level in the configuration file.
2	Write the CORBA client application.

- Step 1: Define the Security Level in the Configuration File
- Step 2: Write the CORBA Client Application

4.4.1 Step 1: Define the Security Level in the Configuration File

The security level for a Oracle Tuxedo domain is defined by setting the `SECURITY` parameter in the `RESOURCES` section of the configuration file to the desired security level. The following table lists the options for the `SECURITY` parameter.

Table 4-2 Options for the SECURITY Parameter

Option	Definition
NONE	No security is implemented in the domain. This option is the default. This option maps to the TOBJ_NOAUTH level of authentication.
APP_PW	Requires that client applications provide an application password during initialization. The tmloadcf command prompts for an application password. This option maps to the TOBJ_SYSAUTH level of authentication.
USER_AUTH	Requires an application password and performs a per-user authentication during the initialization of the client application. This option maps to the TOBJ_APPAUTH level of authentication.

In the Security sample application, the SECURITY parameter is set to APP_PW for application-level security. For information about adding security to a Oracle Tuxedo CORBA application, see Using Security in CORBA Applications in the Oracle Tuxedo online documentation.

4.4.2 Step 2: Write the CORBA Client Application

Write client application code that does the following:

1. Uses the Bootstrap object to obtain a reference to the SecurityCurrent object for the specific Oracle Tuxedo domain.
2. Gets the PrincipalAuthenticator object from the SecurityCurrent object.
3. Uses the get_auth_type() operation of the PrincipalAuthenticator object to return the type of authentication expected by the Oracle Tuxedo domain.

The following code snippet includes the portions of the CORBA C++ client applications in the Security sample application that illustrate the development steps for security.

```
CORBA::Object_var var_security_current_oref =
        bootstrap.resolve_initial_references("SecurityCurrent");
SecurityLevel2::Current_var var_security_current_ref =
        SecurityLevel2::Current::_narrow(var_security_current_oref.in());
//Get the PrincipalAuthenticator
SecurityLevel2::PrincipalAuthenticator_var var_principal_authenticator_oref =
        var_security_current_ref - > principal_authenticator();
//Narrow the PrincipalAuthenticator
Tobj::PrincipalAuthenticator_var var_bea_principal_authenticator =
        Tobj::PrincipalAuthenticator::_narrow(
                var_principal_authenticator_oref.in());
//Determine the security level
Tobj::AuthType auth_type = var_bea_principal_authenticator - >
get_auth_type();
Security::AuthenticationStatus status = var_bea_principalauthenticator - >
logon(
        user_name,
        client_name,
        system_password,
        user_password,
        0);
```

5
Using Transactions

> **Note:**
>
> This topic describes using the C++ interface to the CORBA Services Object Transaction service. For a complete description of all the transaction features available in the CORBA environment of the Oracle Tuxedo product and instructions for implementing the transaction features, see Using CORBA Transactions in the Oracle Tuxedo online documentation. The Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB were deprecated in Tuxedo 8.1 and are no longer supported. All Oracle Tuxedo CORBA Java client and Oracle Tuxedo CORBA Java client ORB text references, associated code samples, should only be used to help implement/run third party Java ORB libraries, and for programmer reference only.
> Technical support for third party CORBA Java ORBs should be provided by their respective vendors. Oracle Tuxedo does not provide any technical support or documentation for third party CORBA Java ORBs.

This topic includes the following sections:

5.1 Overview of the Transaction Service

One of the most fundamental features of the Oracle Tuxedo product is transaction management. Transactions are a means to guarantee that database transactions are completed accurately and that they take on all the ACID properties (atomicity, consistency, isolation, and durability) of a high-performance transaction. The Oracle Tuxedo system protects the integrity of your transactions by providing a complete infrastructure for ensuring that database updates are done accurately, even across a variety of resource managers.

The Oracle Tuxedo system uses the following:

- The CORBA Services Object Transaction Service (OTS)

The CORBA environment in the Oracle Tuxedo product provides a C++ interface to the Object Transaction Service. The OTS is accessed through the TransactionCurrent environmental object. For information about using the TransactionCurrent environmental object, see Creating CORBA Client Applications in the Oracle Tuxedo online documentation.

OTS provides the following support for your business transactions:

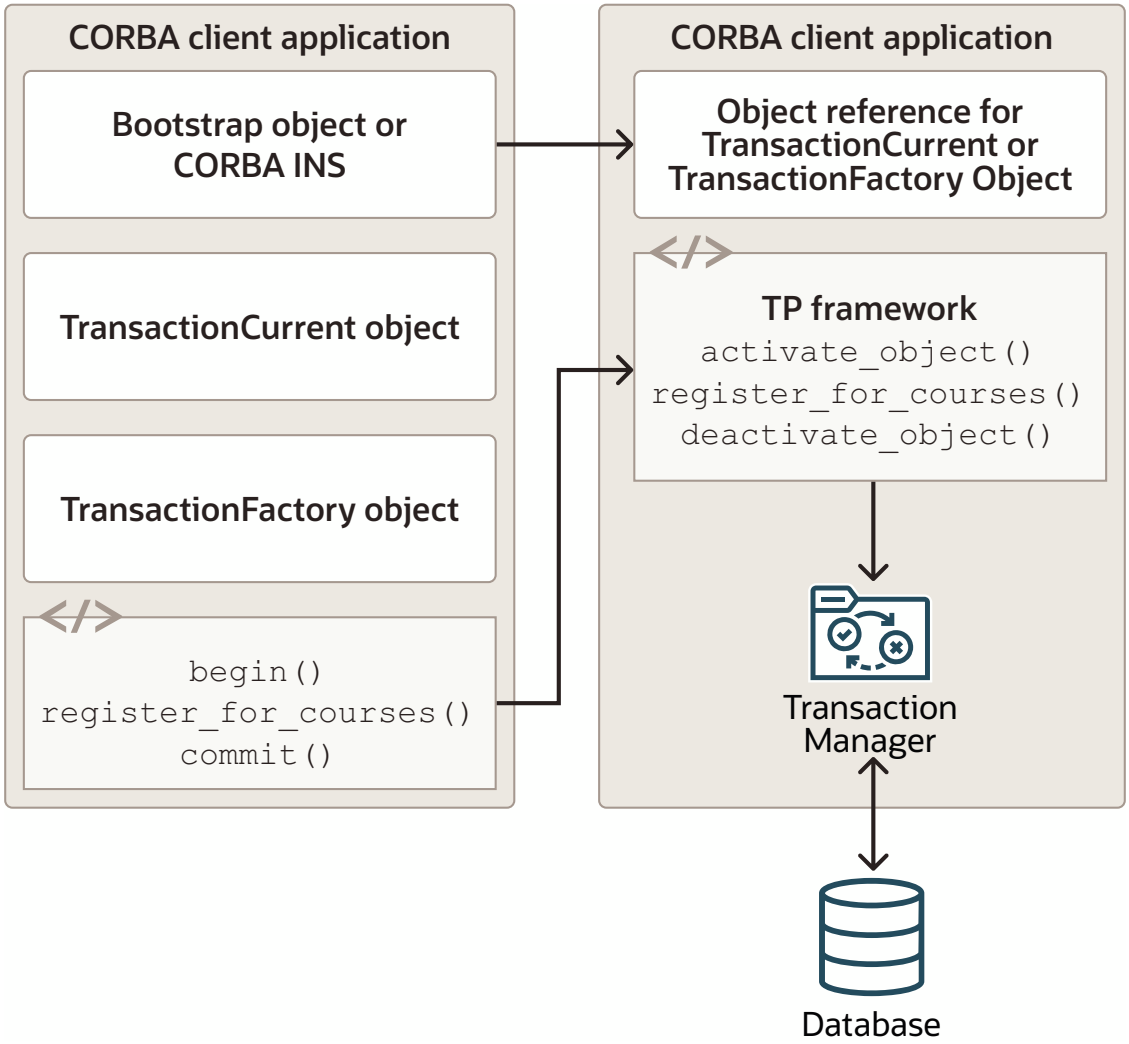
- Creates a global transaction identifier when a client application initiates a transaction.

- Works with the TP Framework to track objects that are involved in a transaction and, therefore, need to be coordinated when the transaction is ready to commit.
- Notifies the resource managers—which are, most often, databases—when they are accessed on behalf of a transaction. Resource managers then lock the accessed records until the end of the transaction.
- Orchestrates the two-phase commit when the transaction completes, which ensures that all the participants in the transaction commit their updates simultaneously. It coordinates the commit with any databases that are being updated using the Open Group XA protocol. Almost all relational databases support this standard.
- Executes the rollback procedure when the transaction must be stopped.
- Executes a recovery procedure when failures occur. It determines which transactions were active in the machine at the time of the crash, and then determines whether the transaction should be rolled back or committed.

5.2 What Happens During a Transaction

The following figure illustrates how transactions work in a Oracle Tuxedo CORBA application.

Figure 5-1 How Transactions Work in a Oracle Tuxedo CORBA Application



A basic transaction works in the following way:

1. The client application uses the Bootstrap object to return an object reference to the TransactionCurrent object for the Oracle Tuxedo domain.
2. A client application begins a transaction using the `Tobj::TransactionCurrent::begin()` method, and issues a request to the CORBA interface through the TP Framework. All operations on the CORBA interface execute within the scope of a transaction.
   - If a call to any of these operations raises an exception (either explicitly or as a result of a communication failure), the exception can be caught and the transaction can be rolled back.
   - If no exceptions occur, the client application commits the current transaction using the `Tobj::TransactionCurrent::commit()` method. This method ends the transaction and starts the processing of the operation. The transaction is committed only if all of the participants in the transaction agree to commit.
3. The `Tobj::TransactionCurrent:commit()` method causes the TP Framework to call the Transaction Manager to complete the transaction.
4. The Transaction Manager updates the database.

> **Note:**
>
> Oracle Tuxedo CORBA also supports the use of the CORBA Interoperable Naming Service (INS) to obtain an initial object reference for the Security Service. For information on the INS bootstrapping mechanism, see the CORBA Programming Reference.

5.3 Transactions Sample Application

In the Transactions sample application, the operation of registering for courses is executed within the scope of a transaction. The transaction model used in the Transactions sample application is a combination of the conversational model and the model in which a single client invocation invokes multiple individual operations on a database.

The Transactions sample application works in the following way:

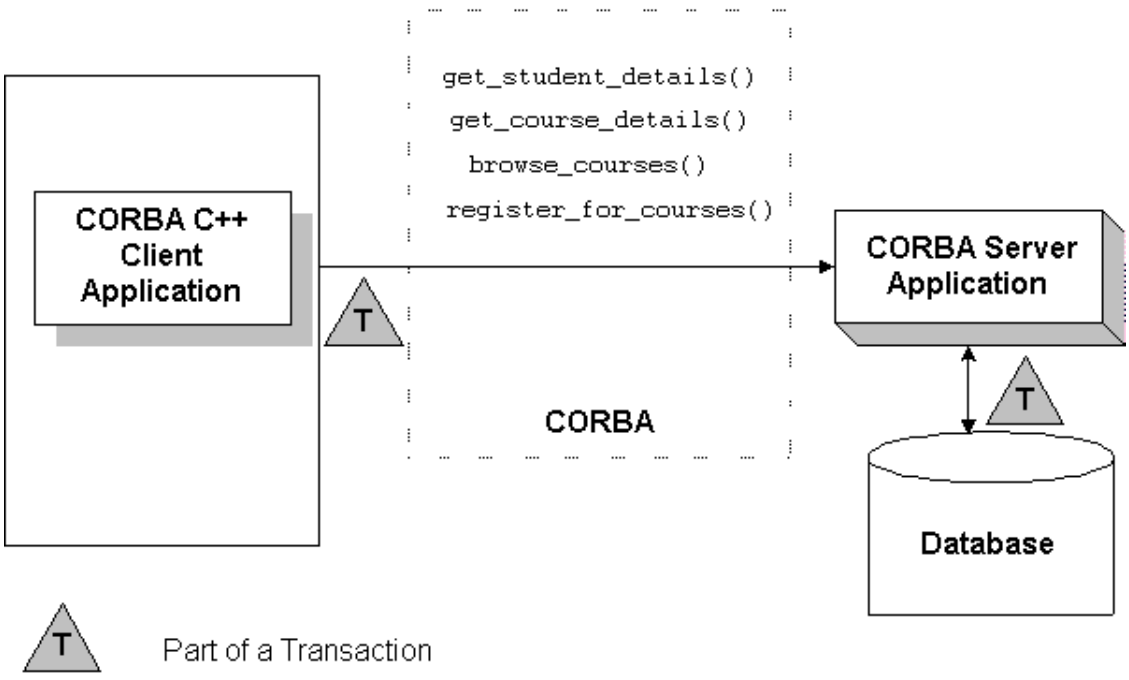
1. Students submit a list of courses for which they want to be registered.
2. For each course in the list, the CORBA server application checks whether:
   - The course is in the database.
   - The student is already registered for a course.
   - The student exceeds the maximum number of credits the student can take.
3. One of the following occurs:
   - If the course meets all the criteria, the CORBA server application registers the student for the course.
   - If the course is not in the database or if the student is already registered for the course, the CORBA server application adds the course to a list of courses for which the student could not be registered. After processing all the registration requests, the CORBA server application returns the list of courses for which registration failed. The CORBA client application can then choose to either commit the transaction (thereby

registering the student for the courses for which registration request succeeded) or to roll back the transaction (thus, not registering the student for any of the courses).

- If the student exceeds the maximum number of credits the student can take, the CORBA server application returns a `TooManyCredits` user exception to the CORBA client application. The CORBA client application provides a brief message explaining that the request was rejected. The CORBA client application then rolls back the transaction.

The following figure illustrates how the Transactions sample application works.

Figure 5-2 Transactions Sample Application



The Transactions sample application shows two ways in which a transaction can be rolled back:

- Nonfatal. If the registration for a course fails because the course is not in the database, or because the student is already registered for the course, the CORBA server application returns the numbers of those courses to the CORBA client application. The decision to roll back the transaction lies with the user of the CORBA client application.
- Fatal. If the registration for a course fails because the student exceeds the maximum number of credits he or she can take, the CORBA server application generates a CORBA exception and returns it to the CORBA client application. The decision to roll back the transaction also lies with the CORBA client application.

5.4 Development Steps

This topic describes the development steps for writing a Oracle Tuxedo CORBA application that includes transactions. The following table lists the development steps.

Table 5-1 Development Steps for Oracle Tuxedo CORBA Applications That Have Transactions

Step	Description
1	Write the OMG IDL code for the transactional CORBA interface.
2	Define the transaction policies for the CORBA interfac in the Implementation Configuration file (ICF).
3	Write the CORBA client application.
4	Write the CORBA server application.
5	Create a configuration file.

The Transactions sample application is used to demonstrate these development steps. The source files for the Transactions sample application are located in the `\samples\corba\university` directory of the Oracle Tuxedo software. For information about building and running the Transactions sample application, see Guide to the CORBA University Sample Application in the Oracle Tuxedo online documentation.

- Step 1: Write the OMG IDL Code
- Step 2: Define Transaction Policies for the Interfaces
- Step 3: Write the CORBA Client Application
- Step 4: Write the CORBA Server Application
- Step 5: Create a Configuration File

5.4.1 Step 1: Write the OMG IDL Code

You need to specify interfaces involved in transactions in Object Management Group (OMG) Interface Definition Language (IDL) just as you would any other CORBA interface. You must also specify any user exceptions that may occur from using the interface.

For the Transactions sample application, you would define in OMG IDL the `Registrar` interface and the `register_for_courses()` operation. The `register_for_courses()` operation has a parameter, `NotRegisteredList`, which returns to the CORBA client application the list of courses for which registration failed. If the value of `NotRegisteredList` is empty, the CORBA client application commits the transaction. You also need to define the `TooManyCredits` user exception.

The following code snippet includes the OMG IDL code for the Transactions sample application.

```
#pragma prefix "beasys.com"

module UniversityT {
  typedef unsigned long CourseNumber;
  typedef sequence<CourseNumber>CourseNumberList;

  struct CourseSynopsis {
    CourseNumber course_number;
    string title;
  }

  ;
  typedef sequence<CourseSynopsis>CourseSynopsisList;
```

```
  interface CourseSynopsisEnumerator {
    //Returns a list of length 0 if there are no more entries
    CourseSynopsisList get_next_n(in unsigned long number_to_get, // 0 =
return all
      out unsigned long number_remaining);
    void destroy();
  }

  ;
  typedef unsigned short Days;
  const Days MONDAY=1;
  const Days TUESDAY=2;
  const Days WEDNESDAY=4;
  const Days THURSDAY=8;
  const Days FRIDAY=16;

  //Classes restricted to same time block on all scheduled days,
  //starting on the hour
  struct ClassSchedule {
    Days class_days; // bitmask of days
    unsigned short start_hour; // whole hours in military time
    unsigned short duration; // minutes
  }

  ;

  struct CourseDetails {
    CourseNumber course_number;
    double cost;
    unsigned short number_of_credits;
    ClassSchedule class_schedule;
    unsigned short number_of_seats;
    string title;
    string professor;
    string description;
  }

  ;
  typedef sequence<CourseDetails>CourseDetailsList;
  typedef unsigned long StudentId;

  struct StudentDetails {
    StudentId student_id;
    string name;
    CourseDetailsList registered_courses;
  }

  ;

  enum NotRegisteredReason {
    AlreadyRegistered,
    NoSuchCourse
  }

  ;
```

```
struct NotRegistered {
  CourseNumber course_number;
  NotRegisteredReason not_registered_reason;
}

;
typedef sequence<NotRegistered>NotRegisteredList;

exception TooManyCredits {
  unsigned short maximum_credits;
}

;

//The Registrar interface is the main interface that allows
//students to access the database.
interface Registrar {
  CourseSynopsisList get_courses_synopsis(in string search_criteria,
    in unsigned long number_to_get,
    out unsigned long number_remaining,
    out CourseSynopsisEnumerator rest);
  CourseDetailsList get_courses_details(in CourseNumberList courses);
  StudentDetails get_student_details(in StudentId student);
  NotRegisteredList register_for_courses(in StudentId student,
    in CourseNumberList courses) raises (TooManyCredits);
}

;

// The RegistrarFactory interface finds Registrar interfaces.
interface RegistrarFactory {
  Registrar find_registrar();
}

;
```

5.4.2 Step 2: Define Transaction Policies for the Interfaces

Transaction policies are used on a per-interface basis. During design, it is decided which interfaces within a Oracle Tuxedo CORBA application will handle transactions. The transaction policies are listed in the following table.

Table 5-2 Transaction Policies

Transaction Policy	Description
`always`	The interface must always be part of a transaction. If the interface is not part of a transaction, a transaction will be automatically started by the TP Framework.
`ignore`	The interface is not transactional; however, requests made to this interface within a scope of a transaction are allowed. The `AUTOTRAN` parameter, specified in the `UBBCONFIG` file for this interface, is ignored.

Table 5-2 (Cont.) Transaction Policies

Transaction Policy	Description
`never`	The interface is not transactional. Objects created for this interface can never be involved in a transaction. The Oracle Tuxedo system generates the `INVALID_TRANSACTION` exception if an interface with this policy is involved in a transaction.
`optional`	The interface might be transactional. Objects can be involved in a transaction if the request is transactional. This transaction policy is the default. Note: To define transactional properties for a request you can also use the autotran parameter.

During development, you decide which interfaces will execute in a transaction by assigning transaction policies.

For CORBA server applications, you specify transaction policies in the Implementation Configuration File (ICF). A template ICF file is created when you run the `genicf` command.

In the Transactions sample application, the transaction policy of the `Registrar` interface is set to `always`.

5.4.3 Step 3: Write the CORBA Client Application

The CORBA client application needs code that performs the following tasks:

1. Obtains a reference to the TransactionCurrent or TransactionFactory object from the Bootstrap object.
2. Begins a transaction by invoking the `Tobj::TransactionCurrent::begin()` operation on the TransactionCurrent object.
3. Invokes operations on the object. In the Transactions sample application, the CORBA client application invokes the `register_for_courses()` operation on the `Registrar` object, passing a list of courses.

The following code snippet illustrates the portion of the CORBA C++ client application in the Transactions sample application that illustrates the development steps for transactions.

```
CORBA::Object_var
var_transaction_current_oref=Bootstrap.resolve_initial_references("Transaction
Current");
CosTransactions::Current_var
var_transaction_current_ref=CosTransactions::Current::_narrow(var_transaction_
current_oref.in());
//Begin the transaction
var_transaction_current_ref->begin();

try {
  // Perform the operation inside the transaction
  pointer_Registar_ref->register_for_courses(student_id, course_number_list);
  // ...
  // If operation executes with no errors, commit the transaction:
  CORBA: :Boolean report_heuristics=CORBA_TRUE;
  var_transaction_current_ref->commit(report_heuristics);
}
```

```
catch (...) {

  // If the operation has problems executing, rollback the
  // transaction. Then throw the original exception again.
  // If the rollback fails, ignore the exception and throw the
  // original exception again.
  try {
    var_transaction_current_ref->rollback();
  }

  catch (...) {
    TP: :userlog("rollback failed");
  }

  throw;
}
```

5.4.4 Step 4: Write the CORBA Server Application

When using transactions in CORBA server applications, you need to write methods that implement the interface's operations. In the Transactions sample application, you would write a method implementation for the `register_for_courses()` operation.

If your Oracle Tuxedo CORBA application uses a database, you need to include code in the CORBA server application that opens and closes an XA resource manager. These operations are included in the `Server::initialize()` and `Server::release()` operations of the Server object.

The following code snippet illustrates the portion of the code for the Server object in the Transactions sample application that opens and closes the XA resource manager.

> **Note:**
>
> For a complete example of a C++ server application that implements transactions, see the Transactions sample application in Using CORBA Transactions in the Oracle Tuxedo online documentation.

```
CORBA::Boolean Server::initialize(int argc, char* argv[]) {
  TRACE_METHOD("Server::initialize");

  try {
    open_database();
    begin_transactional();
    register_fact();
    return CORBA_TRUE;
  }

  catch (CORBA::Exception& e) {
    LOG("CORBA exception : "<<e);
  }

  catch (SamplesDBException& e) {
    LOG("Can't connect to database");
```

```
  }

  catch (...) {
    LOG("Unexpected exception");
  }

  cleanup();
  return CORBA_FALSE;
}

void Server::release() {
  TRACE_METHOD("Server::release");
  cleanup();
}

static void cleanup() {
  unregister_factory();
  end_transactional();
  close_database();
}

// Utilities to manage transaction resource manager
CORBA::Boolean s_became_transactional=CORBA_FALSE;

static void begin_transactional() {
  TP: :open_xa_rm();
  s_became_transactional=CORBA_TRUE;
}

static void end_transactional() {
  if( !s_became_transactional) {
    // cleanup not necessary
    return;
  }

  try {
    TP: :close_xa_rm ();
  }

  catch (CORBA::Exception& e) {
    LOG("CORBA Exception : "<< e);
  }

  catch (...) {
    LOG("unexpected exception");
  }

  s_became_transactional=CORBA_FALSE;
}
```

5.4.5 Step 5: Create a Configuration File

You need to add the following information to the configuration file for a transactional Oracle Tuxedo CORBA application.

- In the `SERVERS` section specify the transactional group for the CORBA server application and for the application that manages the database.
- In the `GROUPS` section define the server group. In the `OPENINFO` and `CLOSEINFO` parameters of the `GROUPS` section, include information to open and close the XA resource manager for the database. You obtain this information from the product documentation for your database. Note that the default version of the `com.beasys.Tobj.Server.initialize()` operation automatically opens the resource manager.
- Include the pathname to the transaction log (`TLOG`) in the `TLOGDEVICE` parameter. For more information about the transaction log, see Administering a Oracle Tuxedo Application at Run Time in the Oracle Tuxedo online documentation.

The following code snippet illustrates the portions of the configuration file that define this information for the Transactions sample application.

```
*RESOURCES
      IPCKEY       55432
      DOMAINID     university
      MASTER       SITE1
      MODEL        SHM
      LDBAL        N
      SECURITY     APP_PW
*MACHINES
      BLOTTO
      LMID = SITE1
      APPDIR = C:\TRANSACTION_SAMPLE
      TUXCONFIG=C:\TRANSACTION_SAMPLE\tuxconfig
      TLOGDEVICE=C:\APP_DIR\TLOG
      TLOGNAME=TLOG
      TUXDIR="C:\tuxdir"
      MAXWSCLIENTS=10
*GROUPS
      SYS_GRP
      LMID       = SITE1
      GRPNO      = 1
      ORA_GRP
      LMID       = SITE1
      GRPNO      = 2
      OPENINFO = "ORACLE_XA:Oracle_XA+SqlNet=ORCL+Acc=P
      /scott/tiger+SesTm=100+LogDir=.+MaxCur=5"
      OPENINFO = "ORACLE_XA:Oracle_XA+Acc=P/scott/tiger
      +SesTm=100+LogDir=.+MaxCur=5"
      CLOSEINFO = ""
      TMSNAME = "TMS_ORA"
*SERVERS
      DEFAULT:
      RESTART = Y
      MAXGEN = 5

      TMSYSEVT
        SRVGRP = SYS_GRP
        SRVID = 1

      TMFFNAME
        SRVGRP = SYS_GRP
        SRVID = 2
```

```
        CLOPT = "-A -- -N -M"

      TMFFNAME
        SRVGRP = SYS_GRP
        SRVID = 3
        CLOPT = "-A -- -N"

      TMFFNAME
        SRVGRP = SYS_GRP
        SRVID = 4
        CLOPT = "-A -- -F"

      TMIFRSVR
        SRVGRP = SYS_GRP
        SRVID = 5

      UNIVT_SERVER
        SRVGRP = ORA_GRP
        SRVID = 1
        RESTART = N

      ISL
        SRVGRP = SYS_GRP
        SRVID = 6
        CLOPT = -A -- -n //MACHINENAME:2500
*SERVICES
```

For information about the transaction log and defining parameters in the Configuration file, see Oracle® Tuxedo Application Configuration Guide in the Oracle Tuxedo online documentation.

Glossary

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