

Oracle® Fusion Middleware

Programming RMI for Oracle WebLogic Server

12c Release 1 (12.1.1)

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This document is written for application developers who want to build e-commerce applications using Remote Method Invocation (RMI) and Internet Interop-Orb-Protocol (IIOP) features.

Oracle Fusion Middleware Programming RMI for Oracle WebLogic Server 12c Release 1 (12.1.1)

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Preface

This preface describes the document accessibility features and conventions used in this guide—*Programming RMI for Oracle WebLogic Server*

Documentation Accessibility

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Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Introduction and Roadmap

This chapter describes the contents and organization of this guide—*Programming RMI for Oracle WebLogic Server*.

- [Section 1.1, "Document Scope and Audience"](#)
- [Section 1.2, "Guide to this Document"](#)
- [Section 1.3, "Related Documentation"](#)
- [Section 1.4, "Samples and Tutorials"](#)
- [Section 1.5, "New and Changed Features in This Release"](#)

1.1 Document Scope and Audience

This document is written for application developers who want to build e-commerce applications using Remote Method Invocation (RMI) and Internet Interop-Orb-Protocol (IIOP) features. It is assumed that readers know Web technologies, object-oriented programming techniques, and the Java programming language. This document emphasizes the value-added features provided by WebLogic Server and key information about how to use WebLogic Server features when developing applications with RMI.

1.2 Guide to this Document

This document describes the Oracle WebLogic Server RMI implementation of the JavaSoft Remote Method Invocation (RMI) specification. The Oracle implementation is known as WebLogic RMI.

- This chapter, [Chapter 1, "Introduction and Roadmap,"](#) introduces the organization of this guide.
- [Chapter 2, "Understanding WebLogic RMI,"](#) is an overview of WebLogic RMI features and its architecture.
- [Chapter 3, "WebLogic RMI Features,"](#) describes the features that you use to program RMI for WebLogic Server.
- [Chapter 4, "Using the WebLogic RMI Compiler,"](#) provides information on the WebLogic RMI compiler.
- [Chapter 5, "Using WebLogic RMI with T3 Protocol,"](#) provides information on using RMI and the T3 protocol.
- [Chapter 6, "How to Implement WebLogic RMI,"](#) provides a simple step by step example of how to implement WebLogic RMI.

- [Chapter 8, "Using RMI over IIOP,"](#) defines RMI over IIOP and provides general information about the WebLogic Server RMI-IIOP implementation.
- [Chapter 9, "Configuring WebLogic Server for RMI-IIOP,"](#) describes concepts, issues, and procedures related to using WebLogic Server to support RMI-IIOP applications.
- [Chapter 10, "Best Practices for Application Design,"](#) describes recommended design patterns when developing RMI and RMI over IIOP applications.
- [Appendix A, "CORBA Support for WebLogic Server,"](#) provides information on CORBA support for WebLogic Server.

1.3 Related Documentation

For information on topics related to WebLogic RMI, see the following documents:

- Java RemoteMethod Invocation (RMI) at <http://download.oracle.com/javase/6/docs/technotes/guides/rmi/> is a link to basic tutorials on Remote Method Invocation.
- *Developing Applications for Oracle WebLogic Server* is a guide to developing WebLogic Server applications.
- *Programming JNDI for Oracle WebLogic Server* is a guide using the WebLogic Java Naming and Directory Interface.
- *Programming Stand-alone Clients for Oracle WebLogic Server* is a guide to developing common stand alone clients that interoperate with WebLogic Server.
- *Performance and Tuning for Oracle WebLogic Server* contains information on monitoring and improving the performance of WebLogic Server applications.
- <http://java.sun.com/j2ee/corba/> provides an overview of CORBA and Java platform.
- <http://download.oracle.com/javase/6/docs/technotes/guides/idl/index.html> contains information using standard IDL (Object Management Group Interface Definition Language) and IIOP.
- <http://www.omg.org> is the Object Management Group home page.
- *CORBA Language Mapping Specification* at <http://www.omg.org/technology/documents/index.htm>

1.4 Samples and Tutorials

In addition to this document, Oracle provides a variety of code samples and tutorials for developers. The examples and tutorials illustrate WebLogic Server in action, and provide practical instructions on how to perform key development tasks.

Oracle recommends that you run some or all of the RMI examples before developing your own applications.

1.4.1 Avitek Medical Records Application (MedRec) and Tutorials

MedRec is an end-to-end sample Java Platform, Enterprise Edition (Java EE) application shipped with WebLogic Server that simulates an independent, centralized medical record management system. The MedRec application provides a framework for patients, doctors, and administrators to manage patient data using a variety of different clients.

MedRec demonstrates WebLogic Server and Java EE features, and highlights Oracle-recommended best practices. MedRec is included in the WebLogic Server distribution, and can be accessed from the Start menu on Windows machines. For Linux and other platforms, you can start MedRec from the `WL_HOME\samples\domains\medrec` directory, where `WL_HOME` is the top-level installation directory for WebLogic Platform.

MedRec includes a service tier comprised primarily of Enterprise Java Beans (EJBs) that work together to process requests from web applications, web services, and workflow applications, and future client applications. The application includes message-driven, stateless session, stateful session, and entity EJBs.

1.4.2 Examples in the WebLogic Server Distribution

WebLogic Server optionally installs API code examples in `WL_HOME\samples\server\examples\src\examples`, where `WL_HOME` is the top-level directory of your WebLogic Server installation. You can start the examples server, and obtain information about the samples and how to run them from the WebLogic Server Start menu.

1.5 New and Changed Features in This Release

For a comprehensive listing of the new WebLogic Server features introduced in this release, see *What's New in Oracle WebLogic Server*.

Understanding WebLogic RMI

This chapter describes the features of WebLogic RMI.

- [Section 2.1, "What is WebLogic RMI?"](#)
- [Section 2.2, "Features of WebLogic RMI"](#)

2.1 What is WebLogic RMI?

Remote Method Invocation (RMI) is the standard for distributed object computing in Java. RMI enables an application to obtain a reference to an object that exists elsewhere in the network, and then invoke methods on that object as though it existed locally in the client's virtual machine. RMI specifies how distributed Java applications should operate over multiple Java virtual machines.

This document contains information about using WebLogic RMI, but it is not a beginner's tutorial on remote objects or writing distributed applications. If you are just beginning to learn about RMI, visit <http://download.oracle.com/javase/1.5.0/docs/guide/rmi/> and review the *RMI Tutorial*.

2.2 Features of WebLogic RMI

The following table highlights important features of WebLogic implementation of RMI:

Table 2–1 *WebLogic RMI Features*

Feature	WebLogic RMI
Overall performance	Enhanced by WebLogic RMI integration into the WebLogic Server framework, which provides underlying support for communications, scalability, management of threads and sockets, efficient garbage collection, and server-related support.
Standards compliant	Compliance with the Java Platform Standard Edition 6.0 API Specification
Failover and Load balancing	WebLogic Server support for failover and load balancing of RMI objects.
WebLogic RMI compiler	Stubs and skeletons dynamically generated by WebLogic RMI at run time, which obviates need to explicitly run <code>weblogic.rmic</code> , except for clusterable or Internet Inter-ORB Protocol (IIOP) clients.

Table 2-1 (Cont.) WebLogic RMI Features

Feature	WebLogic RMI
Dynamic Proxies	A class used by the clients of a remote object. In the case of RMI, skeleton and a stub classes are used. The stub class is the instance that is invoked upon in the client's Java Virtual Machine (JVM). The skeleton class, which exists in the remote JVM, unmarshals the invoked method and arguments on the remote JVM, invokes the method on the instance of the remote object, and then marshals the results for return to the client.
Security Support	No Security Manager required. WebLogic Server implements authentication, authorization, and Java EE security services.
Transaction Support	WebLogic Server supports transactions in the Java Platform, Enterprise Edition (Java EE) programming model.
Internet Protocol version 6 (IPv6) Support	Support for 128 bit addressing space.

WebLogic RMI Features

This chapter describes the WebLogic RMI features and guidelines required to program RMI for use with WebLogic Server.

This chapter includes the following sections:

- [Section 3.1, "WebLogic RMI Overview"](#)
- [Section 3.2, "WebLogic RMI Security Support"](#)
- [Section 3.3, "WebLogic RMI Transaction Support"](#)
- [Section 3.4, "Failover and Load Balancing RMI Objects"](#)
- [Section 3.5, "Creating Pinned Services"](#)
- [Section 3.6, "Dynamic Proxies in RMI"](#)
- [Section 3.7, "Using the RMI Timeout"](#)

3.1 WebLogic RMI Overview

WebLogic RMI is divided between a client and server framework. The client run time does not have server sockets and therefore does not listen for connections. It obtains its connections through the server. Only the server knows about the client socket. Therefore if you plan to host a remote object on the client, you must connect the client to WebLogic Server. WebLogic Server processes requests for and passes information to the client. In other words, client-side RMI objects can only be reached through a single WebLogic Server, even in a cluster. If a client-side RMI object is bound into the JNDI naming service, it only be reachable as long as the server that carried out the bind is reachable.

3.2 WebLogic RMI Security Support

WebLogic Server implements authentication, authorization, and Java EE security services. For more information see *Programming WebLogic Security*.

3.3 WebLogic RMI Transaction Support

WebLogic Server supports transactions in the Java Platform, Enterprise Edition (Java EE) programming model. For detailed information on using transactions in WebLogic RMI applications, see the following:

- "Transactions in WebLogic Server RMI Applications" in *Programming JTA for Oracle WebLogic Server* provides an overview on how transactions are implemented in WebLogic RMI applications.

- "Transactions in RMI Applications" in *Programming JTA for Oracle WebLogic Server* provides general guidelines when implementing transactions in RMI applications for WebLogic Server.

3.4 Failover and Load Balancing RMI Objects

The following sections contain information on WebLogic Server support for failover and load balancing of RMI objects:

- [Section 3.4.1, "Clustered RMI Applications"](#)
- [Section 3.4.2, "Load Balancing RMI Objects"](#)
- [Section 3.4.3, "Parameter-Based Routing for Clustered Objects"](#)
- [Section 7, "WebLogic RMI Integration with Load Balancers"](#)

3.4.1 Clustered RMI Applications

For clustered RMI applications, failover is accomplished using the object's replica-aware stub. When a client makes a call through a replica-aware stub to a service that fails, the stub detects the failure and retries the call on another replica.

To make Java EE services available to a client, WebLogic binds an RMI stub for a particular service into its JNDI tree under a particular name. The RMI stub is updated with the location of other instances of the RMI object as the instances are deployed to other servers in the cluster. If a server within the cluster fails, the RMI stubs in the other server's JNDI tree are updated to reflect the server failure.

You specify the generation of replica-aware stubs for a specific RMI object using the `-clusterable` option of the WebLogic RMI compiler, as explained in [Table 4-1, "WebLogic RMI Compiler Options"](#). For example:

```
$ java weblogic.rmic -clusterable classes
```

For more information, see "Replication and Failover for EJBs and RMIs" in *Using Clusters for Oracle WebLogic Server*.

3.4.2 Load Balancing RMI Objects

The load balancing algorithm for an RMI object is maintained in the replica-aware stub obtained for a clustered object. You specify the load balancing algorithm for a specific RMI object using the `-loadAlgorithm <algorithm>` option of the WebLogic RMI compiler. A load balancing algorithm that you configure for an object overrides the default load balancing algorithm for the cluster. The WebLogic Server RMI compiler supports the following load balancing algorithms:

- "Round Robin Load Balancing"
- "Weight-Based Load Balancing"
- "Random Load Balancing"
- "Server Affinity Load Balancing Algorithms"

For example, to set load balancing on an RMI object to round robin, use the following `rmic` options:

```
$ java weblogic.rmic -clusterable -loadAlgorithm round-robin classes
```

To set load balancing on an RMI object to weight-based server affinity, use `rmic` options:


```
$ java weblogic.rmic -clusterable -loadAlgorithm weight-based
-stickToFirstServer classes
```

For more information, see "Load Balancing for EJBs and RMI Objects" in *Using Clusters for Oracle WebLogic Server*.

3.4.3 Parameter-Based Routing for Clustered Objects

Parameter-based routing allows you to control load balancing behavior at a lower level. Any clustered object can be assigned a `CallRouter` using the `weblogic.rmi.cluster.CallRouter` interface. This is a class that is called before each invocation with the parameters of the call. The `CallRouter` is free to examine the parameters and return the name server to which the call should be routed.

```
weblogic.rmi.cluster.CallRouter.
```

```
Class java.lang.Object
Interface weblogic.rmi.cluster.CallRouter
    (extends java.io.Serializable)
```

A class implementing this interface must be provided to the RMI compiler (`rmic`) to enable parameter-based routing. Run `rmic` on the service implementation using these options (to be entered on one line):

```
$ java weblogic.rmic -clusterable -callRouter <callRouterClass>
<remoteObjectClass>
```

The call router is called by the clusterable stub each time a remote method is invoked. The router is responsible for returning the name of the server to which the call should be routed.

Each server in the cluster is uniquely identified by its name as defined with the WebLogic Server Console. These are the names that the method router must use for identifying servers.

Consider the `ExampleImpl` class which implements a remote interface `Example`, with one method `foo`:

```
public class ExampleImpl implements Example {
    public void foo(String arg) { return arg; }
}
```

This `CallRouter` implementation `ExampleRouter` ensures that all `foo` calls with `'arg' < "n "` go to server1 (or server3 if server1 is unreachable) and that all calls with `'arg' >= "n "` go to server2 (or server3 if server2 is unreachable).

```
public class ExampleRouter implements CallRouter {
    private static final String[] aToM = { "server1", "server3" };
    private static final String[] nToZ = { "server2", "server3" };

    public String[] getServerList(Method m, Object[] params) {
        if (m.GetName().equals("foo")) {
            if (((String)params[0]).charAt(0) < 'n') {
                return aToM;
            } else {
                return nToZ;
            }
        } else {
            return null;
        }
    }
}
```

```
}
```

This `rmic` call associates the `ExampleRouter` with `ExampleImpl` to enable parameter-based routing:

```
$ rmic -clusterable -callRouter ExampleRouter ExampleImpl
```

3.4.3.1 Custom Call Routing and Collocation Optimization

If a replica is available on the same server instance as the object calling it, the call is not load-balanced as it is more efficient to use the local replica. For more information, see "Optimization for Collocated Objects" in *Using Clusters for Oracle WebLogic Server*.

3.5 Creating Pinned Services

You can also use `weblogic.rmic` to generate stubs that are not replicated in the cluster. These stubs are known as "pinned" services, because after they are registered they are available only from the host with which they are registered and will not provide transparent failover or load balancing. Pinned services are available cluster-wide, because they are bound into the replicated cluster-wide JNDI tree. However, if the individual server that hosts the pinned services fails, the client cannot failover to another server.

You specify the generation of non-replicated stubs for a specific RMI object by not using the `-clusterable` option of the WebLogic RMI compiler, as explained in [Table 4-1, "WebLogic RMI Compiler Options"](#). For example:

```
$ java weblogic.rmic classes
```

3.6 Dynamic Proxies in RMI

A dynamic proxy or proxy is a class used by the clients of a remote object. This class implements a list of interfaces specified at runtime when the class is created. In the case of RMI, dynamically generated bytecode and proxy classes are used. The proxy class is the instance that is invoked upon in the client's Java Virtual Machine (JVM). The proxy class marshals the invoked method name and its arguments; forwards these to the remote JVM. After the remote invocation is completed and returns, the proxy class unmarshals the results on the client. The generated bytecode — which exists in the remote JVM — unmarshals the invoked method and arguments on the remote JVM, invokes the method on the instance of the remote object, and then marshals the results for return to the client.

3.7 Using the RMI Timeout

WebLogic Server allows you to specify a timeout for synchronous remote call. This allows an RMI client making a remote call to return before the remote method that it invoked has returned from the server instance it called. This can be useful in legacy applications where a client wants to be able to return quickly if there is no response from the remote system. See [Section 10.5, "Guidelines on Using the RMI Timeout."](#)

To implement a synchronous RMI timeout, use the `remote-client-timeout` deployment descriptor element found in the `weblogic-ejb-jar.xml`. For more information, see the "weblogic-ejb-jar.xml Deployment Descriptor Reference" in *Programming Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

Using the WebLogic RMI Compiler

This chapter describes how to use the features and options of the WebLogic RMI compiler.

This chapter includes the following sections:

- [Section 4.1, "Overview of the WebLogic RMI Compiler"](#)
- [Section 4.2, "WebLogic RMI Compiler Features"](#)
- [Section 4.3, "WebLogic RMI Compiler Options"](#)

4.1 Overview of the WebLogic RMI Compiler

The WebLogic RMI compiler (`weblogic.rmic`) is a command-line utility for generating and compiling remote objects. Use `weblogic.rmic` to generate dynamic proxies on the client-side for custom remote object interfaces in your application and provide hot code generation for server-side objects.

You only need to explicitly run `weblogic.rmic` for clusterable or IIOP clients. WebLogic RMI over IIOP extends the RMI programming model by providing the ability for clients to access RMI remote objects using the Internet Inter-ORB Protocol (IIOP). See [Chapter 8, "Using RMI over IIOP."](#)

4.2 WebLogic RMI Compiler Features

The following sections provide information on WebLogic RMI Compiler features for this release:

- [Section 4.2.1, "Hot Code Generation"](#)
- [Section 4.2.2, "Proxy Generation"](#)
- [Section 4.2.3, "Additional WebLogic RMI Compiler Features"](#)

4.2.1 Hot Code Generation

When you run `rmic`, you use WebLogic Server's hot code generation feature to automatically generate bytecode in memory for server classes. This bytecode is generated on the fly as needed for the remote object. WebLogic Server no longer generates the skeleton class for the object when `weblogic.rmic` is run.

Hot code generation produces the bytecode for a server-side class that processes requests from the dynamic proxy on the client. The dynamically created bytecode de-serializes client requests and executes them against the implementation classes, serializing results and sending them back to the proxy on the client. The

implementation for the class is bound to a name in the WebLogic RMI registry in WebLogic Server.

4.2.2 Proxy Generation

The default behavior of the WebLogic RMI compiler is to produce proxies for the remote interface and for the remote classes to share the proxies. A proxy is a class used by the clients of a remote object. In the case of RMI, dynamically generated bytecode and proxy classes are used.

For example, `example.hello.HelloImpl` and `counter.example.CiaoImpl` are represented by a single proxy class and bytecode—the proxy that matches the remote interface implemented by the remote object, in this case, `example.hello.Hello`.

When a remote object implements more than one interface, the proxy names and packages are determined by encoding the set of interfaces. You can override this default behavior with the WebLogic RMI compiler option `-nomanglednames`, which causes the compiler to produce proxies specific to the remote class. When a class-specific proxy is found, it takes precedence over the interface-specific proxy.

In addition, with WebLogic RMI proxy classes, the proxies are not final. References to collocated remote objects are references to the objects themselves, not to the proxies.

The dynamic proxy class is the serializable class that is passed to the client. A client acquires the proxy for the class by looking up the class in the WebLogic RMI registry. The client calls methods on the proxy just as if it were a local class and the proxy serializes the requests and sends them to WebLogic Server.

4.2.3 Additional WebLogic RMI Compiler Features

Other features of the WebLogic RMI compiler include the following:

- Signatures of remote methods do not need to throw `RemoteException`.
- Remote exceptions can be mapped to `RuntimeException`.
- Remote classes can also implement non-remote interfaces.

4.3 WebLogic RMI Compiler Options

The WebLogic RMI compiler accepts any option supported by the Java compiler; for example, you could add `-d \classes examples.hello.HelloImpl` to the compiler option at the command line. All other options supported by the Java compiler can be used and are passed directly to the Java compiler.

The following table lists `java weblogic.rmic` options. Enter these options after `java weblogic.rmic` and before the name of the remote class.

```
$java weblogic.rmic [options] <classes>...
```

Table 4–1 WebLogic RMI Compiler Options

Option	Description
<code>-help</code>	Prints a description of the options.
<code>-version</code>	Prints version information.
<code>-d <dir></code>	Specifies the target (top level) directory for compilation.

Table 4–1 (Cont.) WebLogic RMI Compiler Options

Option	Description
-dispatchPolicy <queueName>	Specifies a configured execute queue that the service should use to obtain execute threads in WebLogic Server. For more information, see "Using Execute Queues to Control Thread Usage" in Performance and Tuning for Oracle WebLogic Server.
-oneway	Specifies all calls are one-way calls.
-idl	Generates IDLs for remote interfaces.
-idlOverwrite	Overwrites existing IDL files.
-idlVerbose	Displays verbose information for IDL information.
-idlDirectory <idlDirectory>	Specifies the directory where IDL files will be created (Default is the current directory).
-idlFactories	Generates factory methods for valuetypes.
-idlNoValueTypes	Prevents the generation of valuetypes and the methods/attributes that contain them.
-idlNoAbstractInterfaces	Prevents the generation of abstract interfaces and the methods/attributes that contain them.
-idlStrict	Generates IDL according to OMG standard.
-idlVisibroker	Generate IDL compatible with Visibroker 4.5 C++.
-idlOrbix	Generate IDL compatible with Orbix 2000 2.0 C++.
-iiopTie	Generate CORBA skeletons using Sun's version of rmic.
-iiopSun	Generate CORBA stubs using Sun's version of rmic.
-nontransactional	Suspends the transaction before making the RMI call and resumes after the call completes.
-compiler <javac>	Specifies the Java compiler. If not specified, the -compilerclass option will be used.
-compilerclass <com.sun.tools.javac.Main>	Compiler class to invoke.
-clusterable	This cluster-specific options marks the service as clusterable (can be hosted by multiple servers in a WebLogic Server cluster). Each hosting object, or replica, is bound into the naming service under a common name. When the service stub is retrieved from the naming service, it contains a replica-aware reference that maintains the list of replicas and performs load-balancing and fail-over between them.
-loadAlgorithm <algorithm>	Only for use in conjunction with -clusterable. Specifies a service-specific algorithm to use for load-balancing and fail-over (Default is weblogic.cluster.loadAlgorithm). Must be one of the following: round-robin, random, or weight-based.

Table 4-1 (Cont.) WebLogic RMI Compiler Options

Option	Description
-callRouter <callRouterClass>	This cluster-specific option used in conjunction with -clusterable specifies the class to be used for routing method calls. This class must implement weblogic.rmi.cluster.CallRouter. If specified, an instance of the class is called before each method call and can designate a server to route to based on the method parameters. This option either returns a server name or null. Null means that you use the current load algorithm.
-stickToFirstServer	This cluster-specific option used in conjunction with -clusterable enables "sticky " load balancing. The server chosen for servicing the first request is used for all subsequent requests.
-methodsAreIdempotent	This cluster-specific option used in conjunction with -clusterable indicates that the methods on this class are idempotent. This allows the stub to attempt recovery from any communication failure, even if it can not ensure that failure occurred before the remote method was invoked. By default (if this option is not used), the stub only retries on failures that are guaranteed to have occurred before the remote method was invoked.
-iiop	Generates IIOP stubs from servers.
-iiopDirectory	Specifies the directory where IIOP proxy classes are written.
-timeout	Used in conjunction with "remote-client-timeout".
-commentary	Emits commentary.
-nomanglednames	Causes the compiler to produce proxies specific to the remote class.
-g	Compile debugging information into the class.
-O	Compile with optimization.
-nowarn	Compile without warnings.
-verbose	Compile with verbose output.
-verboseJavac	Enable Java compiler verbose output.
-nowrite	Prevent the generation of .class files.
-deprecation	Provides warnings for deprecated calls.
-classpath <path>	Specifies the classpath to use.
-J<option>	Use to pass flags through to the Java runtime.
-keepgenerated	Allows you to keep the source of generated stub and skeleton class files when you run the WebLogic RMI compiler.
-disableHotCodeGen	Causes the compiler to create stubs at skeleton classes when compiled.

4.3.1 Non-Replicated Stub Generation

You can also use `weblogic.rmic` to generate stubs that are not replicated in the cluster. These stubs are known as "pinned " services, because after they are registered they are available only from the host with which they are registered and will not

provide transparent failover or load balancing. Pinned services are available cluster-wide, because they are bound into the replicated cluster-wide JNDI tree. However, if the individual server that hosts the pinned services fails, the client cannot failover to another server.

4.3.2 Using Persistent Compiler Options

During deployment, appc and ejbc run each EJB container class through the RMI compiler to create RMI descriptors necessary to dynamically generate stubs and skeletons. Use the `weblogic-ejb-jar.xml` file to persist `iiop-security-descriptor` elements. For more information, see "weblogic-ejb-jar.xml Elements" in *Programming Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

Using WebLogic RMI with T3 Protocol

This chapter provides information on using WebLogic RMI with T3 protocol.

This chapter includes the following sections:

- [Section 5.1, "RMI Communication in WebLogic Server"](#)
- [Section 5.2, "Determining Connection Availability"](#)
- [Section 5.3, "Using a WebLogic T3/T3s Client Proxy"](#)

5.1 RMI Communication in WebLogic Server

RMI communications in WebLogic Server use the T3 protocol to transport data between WebLogic Server and other Java programs, including clients and other WebLogic Server instances. A server instance keeps track of each Java Virtual Machine (JVM) with which it connects, and creates a single T3 connection to carry all traffic for a JVM. See "Configure T3 protocol" in *Oracle WebLogic Server Administration Console Help*.

For example, if a Java client accesses an enterprise bean and a JDBC connection pool on WebLogic Server, a single network connection is established between the WebLogic Server JVM and the client JVM. The EJB and JDBC services can be written as if they had sole use of a dedicated network connection because the T3 protocol invisibly multiplexes packets on the single connection.

5.2 Determining Connection Availability

Any two Java programs with a valid T3 connection—such as two server instances, or a server instance and a Java client—use periodic point-to-point "heartbeats" to announce and determine continued availability. Each end point periodically issues a heartbeat to the peer, and similarly, determines that the peer is still available based on continued receipt of heartbeats from the peer.

- The frequency with which a server instance issues heartbeats is determined by the *heartbeat interval*, which by default is 60 seconds.
- The number of missed heartbeats from a peer that a server instance waits before deciding the peer is unavailable is determined by the *heartbeat period*, which by default, is 4. Hence, each server instance waits up to 240 seconds, or 4 minutes, with no messages—either heartbeats or other communication—from a peer before deciding that the peer is unreachable.
- Changing timeout defaults is not recommended.

5.3 Using a WebLogic T3/T3s Client Proxy

The WebLogic T3/T3s Client Proxy provides the ability to route outbound client requests to a proxy WebLogic T3 server. In this situation, each client routes all outbound requests to the proxy server. The proxy server then directs the request to the WebLogic Server instance that services the request. On both of client and server side, the configuration affects all applications using a T3 connection as client. For example, if an application creates T3 connection to access a WebLogic T3 server, such as calling methods on remote objects using WebLogic RMI, the proxy configuration is applied to the connection logic.

To enable a client proxy, set the following properties:

T3:

```
-Dhttp.proxyHost=<proxy hostname>  
-Dhttp.proxyPort=<proxy port>  
-Dhttp.nonProxyHosts=<hostnames>
```

T3s:

```
-Dhttps.proxyHost=<proxy hostname>  
-Dhttps.proxyPort=<proxy port>  
-Dhttps.nonProxyHosts=<hostnames>
```

where:

- *proxy hostname* is the network address of the user's proxy server.
- *proxy port* is the port number. If not explicitly set, the value of the port number is set to 80.
- *hostnames* is a "|" separated list of one or more host names that WebLogic Server excludes from a proxy configuration. You can use the wildcard character "*" for matching. For example:
-Dhttp.nonProxyHosts="*.oracle.com|localhost".

How to Implement WebLogic RMI

This chapter describes the `java.rmi.Remote` interface which is the basic building block for all remote objects even though it contains no methods. You extend this "tagging" interface—that is, it functions as a tag to identify remote classes—to create your own remote interface, with method stubs that create a structure for your remote object. Then you implement your own remote interface with a remote class. This implementation is bound to a name in the registry, where a client or server can look up the object and use it remotely.

If you have written RMI classes, you can drop them in WebLogic RMI by changing the import statement on a remote interface and the classes that extend it. To add remote invocation to your client applications, look up the object by name in the registry. WebLogic RMI exceptions are identical to and extend `java.rmi` exceptions so that existing interfaces and implementations do not have to change exception handling.

6.1 Procedures for Implementing WebLogic RMI

The following sections describe how to implement WebLogic Server RMI:

- [Section 6.1.1, "Creating Classes That Can Be Invoked Remotely"](#)
 - [Section 6.1.1.1, "Step 1. Write a Remote Interface"](#)
 - [Section 6.1.1.2, "Step 2. Implement the Remote Interface"](#)
 - [Section 6.1.1.3, "Step 3. Compile the Java Class"](#)
 - [Section 6.1.1.4, "Step 4. Compile the Implementation Class with RMI Compiler"](#)
 - [Section 6.1.1.5, "Step 5: Write Code That Invokes Remote Methods"](#)
- [Section 6.1.2, "Hello Code Sample"](#)

6.1.1 Creating Classes That Can Be Invoked Remotely

You can write your own WebLogic RMI classes in just a few steps. Here is a simple example.

6.1.1.1 Step 1. Write a Remote Interface

Every class that can be remotely invoked implements a remote interface. Using a Java code text editor, write the remote interface in adherence with the following guidelines.

- A remote interface must extend the interface `java.rmi.Remote`, which contains no method signatures. Include method signatures that will be implemented in every

remote class that implements the interface. For detailed information on how to write an interface, see the JavaSoft tutorial *Creating Interfaces*.

- The remote interface must be public. Otherwise a client gets an error when attempting to load a remote object that implements it.
- Unlike the JavaSoft RMI, it is not necessary for each method in the interface to declare `java.rmi.RemoteException` in its throws block. The exceptions that your application throws can be specific to your application, and can extend `RuntimeException`. WebLogic RMI subclasses `java.rmi.RemoteException`, so if you already have existing RMI classes, you will not have to change your exception handling.
- Your Remote interface may not contain much code. All you need are the method signatures for methods you want to implement in remote classes.

Here is an example of a remote interface with the method signature `sayHello()`.

```
package examples.rmi.multihello;
import java.rmi.*;
public interface Hello extends java.rmi.Remote {
    String sayHello() throws RemoteException;
}
```

With JavaSoft's RMI, every class that implements a remote interface must have accompanying, precompiled proxies. WebLogic RMI supports more flexible runtime code generation; WebLogic RMI supports dynamic proxies and dynamically created bytecode that are type-correct but are otherwise independent of the class that implements the interface. If a class implements a single remote interface, the proxy and bytecode that is generated by the compiler will have the same name as the remote interface. If a class implements more than one remote interface, the name of the proxy and bytecode that result from the compilation depend on the name mangling used by the compiler.

6.1.1.2 Step 2. Implement the Remote Interface

Still using a Java code text editor, write the class to be invoked remotely. The class should implement the remote interface that you wrote in Step 1, which means that you implement the method signatures that are contained in the interface. Currently, all the code generation that takes place in WebLogic RMI is dependent on this class file.

With WebLogic RMI, your class does not need to extend `UnicastRemoteObject`, which is required by JavaSoft RMI. (You can extend `UnicastRemoteObject`, but it isn't necessary.) This allows you to retain a class hierarchy that makes sense for your application.

Note: With WebLogic Server, you can use both WebLogic RMI and standard JDK RMI. If you use WebLogic RMI, then you must use `java weblogic.rmic ...` as the `rmic` compiler and you must not create your RMI implementation as a subclass of `java.rmi.server.UnicastRemoteObject`. If you use standard JDK RMI, then you must use `%JAVA_HOME%\bin\rmic` as the `rmic` compiler and you must create your RMI implementation class as a subclass of `java.rmi.server.UnicastRemoteObject`.

Your class can implement more than one remote interface. Your class can also define methods that are not in the remote interface, but you cannot invoke those methods remotely.

This example implements a class that creates multiple `HelloImpls` and binds each to a unique name in the registry. The method `sayHello()` greets the user and identifies the object which was remotely invoked.

```
package examples.rmi.multihello;
import java.rmi.*;
public class HelloImpl implements Hello {
    private String name;
    public HelloImpl(String s) throws RemoteException {
        name = s;
    }
    public String sayHello() throws RemoteException {
        return "Hello! From " + name;
    }
}
```

Next, write a `main()` method that creates an instance of the remote object and registers it in the WebLogic RMI registry, by binding it to a name (a URL that points to the implementation of the object). A client that needs to obtain a proxy to use the object remotely will be able to look up the object by name.

Below is an example of a `main()` method for the `HelloImpl` class. This registers the `HelloImpl` object under the name `HelloRemoteWorld` in a WebLogic Server registry.

```
public static void main(String[] argv) {
    // Not needed with WebLogic RMI
    // System.setSecurityManager(new RmiSecurityManager());
    // But if you include this line of code, you should make
    // it conditional, as shown here:
    // if (System.getSecurityManager() == null)
    //     System.setSecurityManager(new RmiSecurityManager());
    int i = 0;
    try {
        for (i = 0; i < 10; i++) {
            HelloImpl obj = new HelloImpl("MultiHelloServer" + i);
            Context.rebind("//localhost/MultiHelloServer" + i, obj);
            System.out.println("MultiHelloServer" + i + " created.");
        }
        System.out.println("Created and registered " + i +
            " MultiHelloImpls.");
    }
    catch (Exception e) {
        System.out.println("HelloImpl error: " + e.getMessage());
        e.printStackTrace();
    }
}
```

WebLogic RMI does not require that you set a Security Manager in order to integrate security into your application. Security is handled by WebLogic Server support for SSL and ACLs. If you must, you may use your own security manager, but do not install it in WebLogic Server.

6.1.1.3 Step 3. Compile the Java Class

Use `javac` or some other Java compiler to compile the `.java` files to produce `.class` files for the remote interface and the class that implements it.

6.1.1.4 Step 4. Compile the Implementation Class with RMI Compiler

Run the WebLogic RMI compiler (`weblogic.rmic`) against the remote class to generate the dynamic proxy and bytecode, on the fly. A proxy is the client-side proxy for a remote object that forwards each WebLogic RMI call to its matching server-side bytecode, which in turn forwards the call to the actual remote object implementation. To run the `weblogic.rmic`, use the command pattern:

```
$ java weblogic.rmic nameOfRemoteClass
```

where `nameOfRemoteClass` is the full package name of the class that implements your Remote interface. With the examples we have used previously, the command would be:

```
$ java weblogic.rmic examples.rmi.hello.HelloImpl
```

Set the flag `-keepgenerated` when you run `weblogic.rmic` if you want to keep the generated source when creating stub or skeleton classes. For a listing of the available command-line options, see [Section 4.3, "WebLogic RMI Compiler Options."](#)

6.1.1.5 Step 5: Write Code That Invokes Remote Methods

Using a Java code text editor, once you compile and install the remote class, the interface it implements, and its proxy and the bytecode on the WebLogic Server, you can add code to a WebLogic client application to invoke methods in the remote class.

In general, it takes just a single line of code to get a reference to the remote object. Do this with the `Naming.lookup()` method. Here is a short WebLogic client application that uses an object created in a previous example.

```
package mypackage.myclient;
import java.rmi.*;

public class HelloWorld throws Exception {

    // Look up the remote object in the
    // WebLogic's registry
    Hello hi = (Hello)Naming.lookup("HelloRemoteWorld");
    // Invoke a method remotely
    String message = hi.sayHello();
    System.out.println(message);
}
```

This example demonstrates using a Java application as the client.

6.1.2 Hello Code Sample

Here is the full code for the `Hello` interface.

```
package examples.rmi.hello;
import java.rmi.*;

public interface Hello extends java.rmi.Remote {

    String sayHello() throws RemoteException;

}
```

Here is the full code for the `HelloImpl` class that implements it:

```
package examples.rmi.hello;
```

```
import java.rmi.*;

public class HelloImpl
    // Don't need this in WebLogic RMI:
    // extends UnicastRemoteObject
    implements Hello {

    public HelloImpl() throws RemoteException {
        super();
    }

    public String sayHello() throws RemoteException {
        return "Hello Remote World!!";
    }

    public static void main(String[] argv) {
        try {
            HelloImpl obj = new HelloImpl();
            Naming.bind("HelloRemoteWorld", obj);
        }
        catch (Exception e) {
            System.out.println("HelloImpl error: " + e.getMessage());
            e.printStackTrace();
        }
    }
}
```

WebLogic RMI Integration with Load Balancers

This chapter describes WebLogic RMI support for load balancers, including hardware load balancers and web servers with a web server plug-in.

This chapter includes the following sections:

- [Section 7.1, "How WebLogic Server Supports Load Balancers"](#)
- [Section 7.2, "HTTP Tunneled T3 Load Balancing"](#)
- [Section 7.3, "Native T3 Load Balancing"](#)
- [Section 7.4, "Failover Support"](#)

7.1 How WebLogic Server Supports Load Balancers

WebLogic Server clients that use RMI can interoperate with a load balancer using the following mechanisms:

- When tunneling T3 over HTTP/HTTPS, WebLogic Server supports routing through a hardware load balancer or a web server with a web server plug-in provided that request forwarding mechanism to the WebLogic Cluster is configured to use sticky session routing. See [Section 7.2, "HTTP Tunneled T3 Load Balancing."](#)
- When using T3 directly, WebLogic Server supports using a hardware load balancer to bootstrap the initial T3 connections to the cluster by specifying a `PROVIDER_URL` that points to the load balancer when creating the `JNDI InitialContext`. See [Section 7.3, "Native T3 Load Balancing."](#)

Note: All other uses of a hardware load balancer with WebLogic RMI are unsupported—regardless of whether or not they work.

7.2 HTTP Tunneled T3 Load Balancing

When tunneling T3 over HTTP (or HTTPS), the WebLogic Server runtime creates an `HttpSession` for each RMI session and passes the session ID back and forth between the client and the server using the normal HTTP mechanisms. This allows the web server plug-in or hardware load balancer to route all RMI requests from a particular client back to the same server in the cluster for the duration of that session.

7.2.1 How to Configure the External Listen Address

WebLogic Server provides an `External Listen Address` to provide an IP address to use in RMI stubs to allow clients to connect to the server through a Network Address Translating (NAT) Firewall. As long as the NAT firewall maps a unique external IP address to the unique internal IP address of the server, each stub delivered to the client uniquely identifies the cluster member holding the object that the stub is a proxy for. The `External Listen Address` is set differently for default and custom network channels:

- For the default channel, use the `ExternalDNSName` attribute on the `ServerMBean`. See "ExternalDNSName" in *Oracle WebLogic Server Administration Console Help*.
- For a custom channel, use the `PublicAddress` and `PublicPort` on the `NetworkAccessMBean`. See "NetworkAccessPointMBean" in *Oracle WebLogic Server Administration Console Help*.

7.2.1.1 Example Custom Channel Configuration for a Load Balancer

Configure a T3 network channel on all WebLogic Server instances in the cluster. The network channel accepts tunneled traffic from the load balancer. To ensure all client requests are routed through the load balancer, set `External Listen Address` to the end point where loadbalancer, or the web server, accepts traffic from the client. Enable HTTP protocol and set `tunneling-enabled=true`. Configure the load balancer or web server to route http traffic to WebLogic Server. If using Oracle HTTP Server (OHS) as a webserver, this can be achieved by changing the `httpd.conf` configuration file. For example:

The WebLogic Server `config.xml`:

```
<network-access-point>
  <name>tunnelChannel</name>
  <protocol>t3</protocol>
  <listen-address>foo.bar.Company.com</listen-address>
  <listen-port>11001</listen-port>
  <http-enabled-for-this-protocol>true</http-enabled-for-this-protocol>
  <tunneling-enabled>true</tunneling-enabled>
  <outbound-enabled>>false</outbound-enabled>
  <enabled>true</enabled>
  <two-way-ssl-enabled>>false</two-way-ssl-enabled>
  <client-certificate-enforced>>false</client-certificate-enforced>
</network-access-point><network-access-point>
. . .
```

OHS/Webtier's `httpd.conf` file

```
<LocationMatch ^/bea_wls_internal/>
  SetHandler weblogic-handler
  WeblogicCluster foo.oracle.com:11001
</LocationMatch>
. . .
```

7.2.2 Session Failover

Session failover is transparent to the client. When a server shuts down the client RJVM receives a `PeerGone` exception. This causes the `HTTPClientJVMConnection` to be closed. When the next request comes from the same client, the request is failed over to the next member in the cluster for both stateless and stateful beans. If an exception

occurs during request processing, that request is not failed over and the exception is propagated to the client.

7.2.3 Cookie Persistence

The tunneling client caches the cookie it receives after initial request and sends it back in every subsequent request.

7.2.4 Pinned Objects

In a cluster, even if an object is pinned and the `replicate_bindings!= false`, the stub is replicated to all the members of the cluster. Tunneling does not affect the normal pinned object behavior.

7.2.5 Stateful Session EJBs

If `External Listen Address` is not set, the stub that the client gets back has the list of available hosts to route to and the behavior is similar to sending direct t3 requests.

If `External Listen Address` is set then failover does not work because the primary and secondary hosts get set to the `external.DNSName` and load balancer hangs trying to route to itself.

7.3 Native T3 Load Balancing

If the cluster member fails, the client invocation on a *non-cluster-aware stub* also fails since the firewall does not attempt to redirect the request to another cluster member. For a cluster-aware stub invocation, the request should be transparently routed around the failure and the invocation delivered to a different cluster member using the `External Listen Address` contained in the cluster-aware stub. See [Section 7.2.1, "How to Configure the External Listen Address."](#)

Use the hardware load balancer to load balance the initial T3 connection request when creating the `JNDI InitialContext` by specifying a `PROVIDER_URL` that points to the load balancer provided that the `External Listen Address` is not set to point to the hardware load balancer. This configuration works because the hardware load balancer is only involved in routing the initial TCP connection request to one of the managed servers. Once the connection is established, all RMI stubs contain the server's `ListenAddress` (or `External Listen Address` in the case of a NAT firewall) that uniquely identifies the server for which the stub is acting as a proxy.

7.4 Failover Support

WebLogic RMI does not support failover when used with a hardware loadbalancer.

For information on how WebLogic Server RMI handles failover, see [Section 3.4, "Failover and Load Balancing RMI Objects."](#)

Using RMI over IIOP

This chapter provides a high-level view of RMI over IIOP (RMI-IIOP) and RMI-IIOP interoperability between this release and prior WebLogic Server releases.

This chapter includes the following sections:

- [Section 8.1, "What is RMI over IIOP?"](#)
- [Section 8.2, "Overview of WebLogic RMI-IIOP"](#)
- [Section 8.3, "Protocol Compatibility"](#)

8.1 What is RMI over IIOP?

RMI over IIOP extends RMI to work across the IIOP protocol. This has two benefits that you can leverage. In a Java to Java paradigm, this allows you to program against the standardized Internet Interop-Orb-Protocol (IIOP). If you are not working in a Java-only environment, it allows your Java programs to interact with Common Object Request Broker Architecture (CORBA) clients and execute CORBA objects. CORBA clients can be written in a variety of languages (including C++) and use the Interface-Definition-Language (IDL) to interact with a remote object.

8.2 Overview of WebLogic RMI-IIOP

WebLogic Server provides its own ORB implementation which is instantiated by default when programs call `ORB.init()`, or when `"java:comp/ORB"` is looked up in JNDI. See [Appendix A, "CORBA Support for WebLogic Server"](#) for information how WebLogic Server complies with specifications for CORBA support in Java SE 1.4.

The WebLogic Server implementation of RMI-IIOP allows you to:

- Connect Java RMI clients to WebLogic Server using the standardized IIOP protocol
- Connect CORBA/IDL clients, including those written in C++, to WebLogic Server
- Interoperate between WebLogic Server and Tuxedo clients
- Connect a variety of clients to EJBs hosted on WebLogic Server

How you develop your RMI-IIOP applications depends on what services and clients you are trying to integrate. See *Programming Stand-alone Clients for Oracle WebLogic Server* for more information on how to create applications for various clients types that use RMI and RMI-IIOP.

The following diagram shows RMI Object Relationships for objects that use IIOP.

Figure 8–1 RMI Object Relationships

8.2.1 Support for RMI-IIOP with RMI (Java) Clients

You can use RMI-IIOP with Java/RMI clients, taking advantage of the standard IIOP protocol. WebLogic Server provides multiple options for using RMI-IIOP in a Java-to-Java environment, including the new Java EE Application Client (thin client), which is based on the new small footprint client jar. To use the new thin client, you need to have the `wlclient.jar` (located in `WL_HOME/server/lib`) on the client side's CLASSPATH. For more information on RMI-IIOP client options, see *Programming Stand-alone Clients for Oracle WebLogic Server*.

8.2.2 Support for RMI-IIOP with Tuxedo Client

WebLogic Server contains an implementation of the WebLogic Tuxedo Connector, an underlying technology that enables you to interoperate with Tuxedo servers. Using WebLogic Tuxedo Connector, you can leverage Tuxedo as an ORB, or integrate legacy Tuxedo systems with applications you have developed on WebLogic Server. For more information, see the *WebLogic Tuxedo Connector Programmer's Guide for Oracle WebLogic Server*.

8.2.3 Support for RMI-IIOP with CORBA/IDL Clients

The developer community requires the ability to access Java EE services from CORBA/IDL clients. However, Java and CORBA are based on very different object models. Because of this, sharing data between objects created in the two programming paradigms was, until recently, limited to Remote and CORBA primitive data types. Neither CORBA structures nor Java objects could be readily passed between disparate objects. To address this limitation, the Object Management Group (OMG) created the *Objects-by-Value Specification* at <http://www.omg.org/technology/documents/index.htm>. This specification defines the enabling technology for exporting the Java object model into the CORBA/IDL programming model--allowing for the interchange of complex data types between the two models. WebLogic Server can support Objects-by-Value with any CORBA ORB that correctly implements the specification.

8.3 Protocol Compatibility

Interoperability between this release and prior WebLogic Server releases is supported in the following scenarios:

- [Section 8.3.1, "Server-to-Server Interoperability"](#)
- [Section 8.3.2, "Client-to-Server Interoperability"](#)

8.3.1 Server-to-Server Interoperability

The following table identifies supported options for achieving interoperability between two WebLogic Server instances.

Table 8–1 WebLogic Server-to-Server Interoperability

Server Interoperability	WebLogic Server 8.1	WebLogic Server 9.x	WebLogic Server 10.x
From WebLogic Server 8.1 to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services
From WebLogic Server 9.x to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services
From WebLogic Server 10.x to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services
Sun JDK ORB client ¹	RMI/IIOP ²	RMI/IIOP ³	RMI/IIOP ⁴

¹ This option involves calling directly into the JDK ORB from within application hosted on WebLogic Server.

² JDK 1.3.x or 1.4.1. No clustering. No transaction propagation

³ JDK 5.0. No clustering. No transaction propagation

⁴ JDK 5.0. No clustering. No transaction propagation

8.3.2 Client-to-Server Interoperability

The following table identifies supported options for achieving interoperability between a stand-alone Java client application and a WebLogic Server instance.

Table 8–2 Client-to-Server Interoperability

Client-to-Server Interoperability	WebLogic Server 8.1	WebLogic Server 9.x	WebLogic Server 10.x
From WebLogic Server 8.1 to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services
From WebLogic Server 9.x to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services
From WebLogic Server 10.x to...	RMI/T3	RMI/T3	RMI/T3
	RMI/IIOP	RMI/IIOP	RMI/IIOP
	HTTP	HTTP	HTTP
	Web Services	Web Services	Web Services

Table 8–2 (Cont.) Client-to-Server Interoperability

Client-to-Server Interoperability	WebLogic Server 8.1	WebLogic Server 9.x	WebLogic Server 10.x
Sun JDK ORB client ¹	RMI/IIOP ²	RMI/IIOP ³	RMI/IIOP ⁴

¹ This option involved calling directly into the JDK ORB from within a client application.

² JDK 1.3.x or 1.4.1. No clustering. No transaction propagation

³ JDK 5.0. No clustering. No transaction propagation

⁴ JDK 5.0. No clustering. No transaction propagation

Configuring WebLogic Server for RMI-IIOP

This chapter describes the concepts and procedures necessary to configure WebLogic Server to interoperate using RMI over IIOP (RMI-IIOP).

This chapter includes the following sections:

- [Section 9.1, "Set the Listening Address"](#)
- [Section 9.2, "Setting Network Channel Addresses"](#)
- [Section 9.3, "Using a IIOPS Thin Client Proxy"](#)
- [Section 9.4, "Using RMI-IIOP with SSL and a Java Client"](#)
- [Section 9.5, "Accessing WebLogic Server Objects from a CORBA Client through Delegation"](#)
- [Section 9.6, "Configuring CSIv2 authentication"](#)
- [Section 9.7, "Using RMI over IIOP with a Hardware Load Balancer"](#)
- [Section 9.8, "Limitations of WebLogic RMI-IIOP"](#)
- [Section 9.9, "Propagating Client Identity"](#)

9.1 Set the Listening Address

To facilitate the use of IIOP, always specify a valid IP address or DNS name for the Listen Address attribute in the configuration file (`config.xml`) to listen for connections.

The Listen Address default value of `null` allows it to "listen on all configured network interfaces". However, this feature only works with the T3 protocol. If you need to configure multiple listen addresses for use with the IIOP protocol, then use the Network Channel feature, as described in *"Configuring Network Resources"* in *Configuring Server Environments for Oracle WebLogic Server*.

9.2 Setting Network Channel Addresses

The following sections provide information to consider when implementing IIOP network channel addresses for thin clients.

9.2.1 Considerations for Proxys and Firewalls

Many typical environments use firewalls, proxys, or other devices that hide the application server's true IP address. Because IIOP relies on a per-object addressing scheme where every object contains a host and port, anything that masks the true IP

address of the server will prevent the external client from maintaining a connection. To prevent this situation, set the `PublicAddress` on the server IIOP network channel to the virtual IP that the client sees.

9.2.1.1 Considerations for Clients with Multiple Connections

IIOP clients publish addressing information that is used by the application server to establish a connection. In some situations, such as running a VPN where clients have more than one connection, the server cannot see the IP address published by the client. In this situation, you have two options:

- Use a bi-directional form of IIOP. Use the following WebLogic flag:

```
-Dweblogic.corba.client.bidir=true
```

In this instance, the server does not need the IP address published by the client because the server uses the inbound connection for outbound requests.

- Use the following JDK property to set the address the server uses for outbound connections:

```
-Dcom.sun.CORBA.ORBServerHost=client_ipaddress
```

where `client_ipaddress` is an address published by the client.

9.3 Using a IIOPS Thin Client Proxy

The IIOPs Thin Client Proxy provides a WebLogic thin client the ability to proxy outbound requests to a server. In this situation, each user routes all outbound requests through their proxy. The user's proxy then directs the request to the WebLogic Server. You should use this method when it is not practical to implement a Network Channel. To enable a proxy, set the following properties:

```
-Diiops.proxyHost=<host>  
-Diiops.proxyPort=<port>
```

where:

- *hostname* is the network address of the user's proxy server.
- *port* is the port number. If not explicitly set, the value of the port number is set to 80.
- *hostname* and *port* support symbolic names, such as:

```
-Diiops.proxyHost=https.proxyHost  
-Diiops.proxyPort=https.proxyPort
```

You should consider the following security implications:

- This feature does not change the behavior of WebLogic Server. However, using this feature does expose IP addresses through the client's firewall. As both ends of the connection are trusted and the linking information is encrypted, this is an acceptable security level for many environments.
- Some production environments do not allow enabling the `CONNECT` attribute on the proxy server. These environments should use HTTPS tunneling. For more information, see "Setting Up WebLogic Server for HTTP Tunneling" in *Configuring Server Environments for Oracle WebLogic Server*.

9.4 Using RMI-IIOP with SSL and a Java Client

The Java clients that support SSL are the thin client and the WLS-IIOP client. To use SSL with these clients, simply specify an `ssl` URL.

9.5 Accessing WebLogic Server Objects from a CORBA Client through Delegation

WebLogic Server provides services that allow CORBA clients to access RMI remote objects. As an alternative method, you can also host a CORBA ORB (Object Request Broker) in WebLogic Server and delegate incoming and outgoing messages to allow CORBA clients to indirectly invoke any object that can be bound in the server.

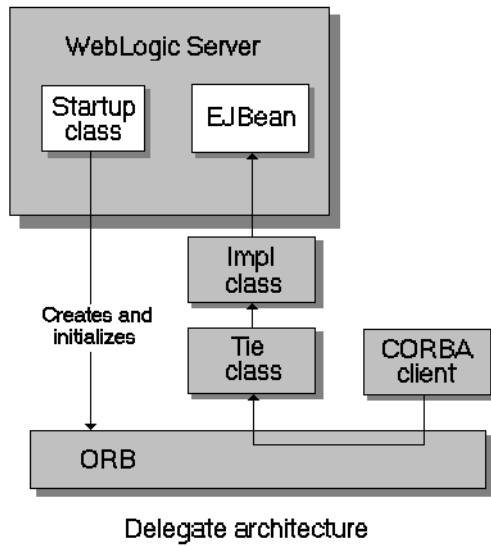
9.5.1 Overview of Delegation

Here are the main steps to create the objects that work together to delegate CORBA calls to an object hosted by WebLogic Server.

1. Create a startup class that creates and initializes an ORB so that the ORB is co-located with the JVM that is running WebLogic Server.
2. Create an IDL (Interface Definition Language) that will create an object to accept incoming messages from the ORB.
3. Compile the IDL. This will generate a number of classes, one of which will be the Tie class. Tie classes are used on the server side to process incoming calls, and dispatch the calls to the proper implementation class. The implementation class is responsible for connecting to the server, looking up the appropriate object, and invoking methods on the object on behalf of the CORBA client.

The following figure is a diagram of a CORBA client invoking an EJB by delegating the call to an implementation class that connects to the server and operates upon the EJB. Using a similar architecture, the reverse situation will also work. You can have a startup class that brings up an ORB and obtains a reference to the CORBA implementation object of interest. This class can make itself available to other WebLogic objects throughout the JNDI tree and delegate the appropriate calls to the CORBA object.

Figure 9–1 CORBA Client Invoking an EJB with a Delegated Call



9.5.2 Example of Delegation

The following code example creates an implementation class that connects to the server, looks up the `Foo` object in the JNDI tree, and calls the `bar` method. This object is also a startup class that is responsible for initializing the CORBA environment by:

- Creating the ORB
- Creating the Tie object
- Associating the implementation class with the Tie object
- Registering the Tie object with the ORB
- Binding the Tie object within the ORB's naming service

```
import org.omg.CosNaming.*;
import org.omg.CosNaming.NamingContextPackage.*;
import org.omg.CORBA.*;
import java.rmi.*;
import javax.naming.*;
import weblogic.jndi.Environment;

public class FooImpl implements Foo
{
    public FooImpl() throws RemoteException {
        super();
    }

    public void bar() throws RemoteException, NamingException {
        // look up and call the instance to delegate the call to...
        weblogic.jndi.Environment env = new Environment();
        Context ctx = env.getInitialContext();
        Foo delegate = (Foo)ctx.lookup("Foo");
        delegate.bar();
        System.out.println("delegate Foo.bar called!");
    }

    public static void main(String args[]) {
        try {
            FooImpl foo = new FooImpl();

```

```

// Create and initialize the ORB
ORB orb = ORB.init(args, null);

// Create and register the tie with the ORB
_FooImpl_Tie fooTie = new _FooImpl_Tie();
fooTie.setTarget(foo);
orb.connect(fooTie);

// Get the naming context
org.omg.CORBA.Object o = \
orb.resolve_initial_references("NameService");
NamingContext ncRef = NamingContextHelper.narrow(o);

// Bind the object reference in naming

NameComponent nc = new NameComponent("Foo", "");
NameComponent path[] = {nc};
ncRef.rebind(path, fooTie);

System.out.println("FooImpl created and bound in the ORB registry.");
}
catch (Exception e) {
System.out.println("FooImpl.main: an exception occurred:");
e.printStackTrace();
}
}
}

```

9.6 Configuring CSIV2 authentication

The Common Secure Interoperability Specification, Version 2 (CSIV2) is an Open Management Group (OMG) specification that addresses the requirements of Common Object Request Broker Architecture (CORBA) security for interoperable authentication, delegation, and privileges. See "Common Secure Interoperability Version 2 (CSIV2)" in *Understanding Security for Oracle WebLogic Server*.

Use the following steps to use CSIV2 to authenticate an inbound call from a remote domain:

1. Update the Identity Asserter. See "Configuring Identity Assertion Providers" in *Securing Oracle WebLogic Server*.
2. Update the User Name Mapper. See "Configuring a User Name Mapper" in *Securing Oracle WebLogic Server*.
3. Add all users required by the application in the remote domain to the WebLogic AuthenticationProvider. See "Create User" in *Oracle WebLogic Server Administration Console Help*.

9.7 Using RMI over IIOP with a Hardware Load Balancer

Note: This feature works correctly only when the bootstrap is through a hardware load-balancer.

An optional enhancement for WebLogic Server Oracle ORB and higher, supports hardware load balancing by forcing reconnection when bootstrapping. This allows hardware load-balancers to balance connection attempts

In most situations, once a connection has been established, the next NameService lookup is performed using the original connection. However, since this feature forces re-negotiation of the end point to the hardware load balancer, all in-flight requests on any existing connection are lost.

Use the `-Dweblogic.system.iiop.reconnectOnBootstrap` system property to set the connection behavior of the Oracle ORB. Valid values are:

- `true`—Forces re-negotiation of the end point.
- `false`—Default value.

Environments requiring a hardware load balancer should set this property to `true`.

9.8 Limitations of WebLogic RMI-IIOP

The following sections outline various issues relating to WebLogic RMI-IIOP.

9.8.1 Limitations Using RMI-IIOP on the Client

Use WebLogic Server with JDK 1.3.1_01 or higher. Earlier versions are not RMI-IIOP compliant. Note the following about these earlier JDKs:

- Send GIOP 1.0 messages and GIOP 1.1 profiles in IORs.
- Do not support the necessary pieces for EJB 2.0 interoperability (GIOP 1.2, codeset negotiation, UTF-16).
- Have bugs in its treatment of mangled method names.
- Do not correctly unmarshal unchecked exceptions.
- Have subtle bugs relating to the encoding of valuetypes.

Many of these items are impossible to support both ways. Where there was a choice, WebLogic supports the spec-compliant option.

9.8.2 Limitations Developing Java IDL Clients

Oracle strongly recommends developing Java clients with the RMI client model if you are going to use RMI-IIOP. Developing a Java IDL client can cause naming conflicts and classpath problems, and you are required to keep the server-side and client-side classes separate. Because the RMI object and the IDL client have different type systems, the class that defines the interface for the server-side will be very different from the class that defines the interface on the client-side.

9.8.3 Limitations of Passing Objects by Value

To pass objects by value, you need to use value types, (see <http://www.omg.org/cgi-bin/doc?formal/01-02-33>, You implement value types on each platform on which they are defined or referenced. This section describes the difficulties of passing complex value types, referencing the particular case of a C++ client accessing an Entity bean on WebLogic Server.

One problem encountered by Java programmers is the use of derived datatypes that are not usually visible. For example, when accessing an EJB finder the Java programmer will see a Collection or Enumeration, but does not pay attention to the

underlying implementation because the JDK run-time will classload it over the network. However, the C++, CORBA programmer must know the type that comes across the wire so that he can register a value type factory for it and the ORB can unmarshal it.

Simply running `ejbc` on the defined EJB interfaces will *not* generate these definitions because they do not appear in the interface. For this reason `ejbc` will also accept Java classes that are not remote interfaces—specifically for the purpose of generating IDL for these interfaces. Review the `/iiop/ejb/entity/cppclient` example to see how to register a value type factory.

Java types that are serializable but that define `writeObject()` are mapped to custom value types in IDL. You must write C++ code to unmarshal the value type manually.

Note: When using Tuxedo, you can specify the `-i` qualifier to direct the IDL compiler to create implementation files named `FileName_i.h` and `FileName_i.cpp`. For example, this syntax creates the `TradeResult_i.h` and `TradeResult_i.cpp` implementation files:

```
idl -IidlSources -i
idlSources\examples\iiop\ejb\iiop\TradeResult.idl
```

The resulting source files provide implementations for application-defined operations on a value type. Implementation files are included in a CORBA client application.

9.9 Propagating Client Identity

Until recently insufficient standards existed for propagating client identity from a CORBA client. If you have problems with client identity from foreign ORBs, you may need to implement one of the following methods:

- The identity of any client connecting over IIOP to WebLogic Server will default to `<anonymous>`. You can set the user and password in the `config.xml` file to establish a single identity for all clients connecting over IIOP to a particular instance of WebLogic Server, as shown in the example below:

```
<Server
Name="myserver"
NativeIOEnabled="true"
DefaultIIOPUser="Bob"
DefaultIIOPPassword="Gumby1234"
ListenPort="7001">
```

- You can also set the `IIOPEnabled` attribute in the `config.xml`. The default value is `"true"`; set this to `"false"` only if you want to disable IIOP support. No additional server configuration is required to use RMI over IIOP beyond ensuring that all remote objects are bound to the JNDI tree to be made available to clients. RMI objects are typically bound to the JNDI tree by a startup class. EJB homes are bound to the JNDI tree at the time of deployment. WebLogic Server implements a `CosNaming Service` by delegating all lookup calls to the JNDI tree.
- This release supports RMI-IIOP `corbaname` and `corbaloc` JNDI references. See <http://www.omg.org/cgi-bin/doc?formal/01-02-33>. One feature of these references is that you can make an EJB or other object hosted on one WebLogic Server available over IIOP to other Application Servers. So, for instance, you could add the following to your `ejb-jar.xml`:

```
<ejb-reference-description>  
<ejb-ref-name>WLS</ejb-ref-name>  
<jndi-name>corbaname:iiop:1.2@localhost:7001#ejb/j2ee/interop/foo</jndi-name>  
</ejb-reference-description>
```

The reference-description stanza maps a resource reference defined in `ejb-jar.xml` to the JNDI name of an actual resource available in WebLogic Server. The `ejb-ref-name` specifies a resource reference name. This is the reference that the EJB provider places within the `ejb-jar.xml` deployment file. The `jndi-name` specifies the JNDI name of an actual resource factory available in WebLogic Server.

Note: The `iiop:1.2` contained in the `<jndi-name>` section. This release contains an implementation of GIOP (General-Inter-Orb-Protocol) 1.2. The GIOP specifies formats for messages that are exchanged between inter-operating ORBs. This allows interoperability with many other ORBs and application servers. The GIOP version can be controlled by the version number in a `corbaname` or `corbaloc` reference.

These methods are not required when using `WLInitialContextFactory` in RMI clients or can be avoided by using the WebLogic C++ client.

Best Practices for Application Design

This chapter describes recommended design patterns when programming with RMI and RMI over IIOP.

This chapter includes the following sections:

- [Section 10.1, "Use java.rmi"](#)
- [Section 10.2, "Use PortableRemoteObject"](#)
- [Section 10.3, "Use WebLogic Work Areas"](#)
- [Section 10.4, "How to Handle Changes in Security Context"](#)
- [Section 10.5, "Guidelines on Using the RMI Timeout"](#)

10.1 Use java.rmi

Oracle recommends RMI users use `java.rmi`, see <http://download.oracle.com/javase/6/docs/api/java/rmi/package-summary.html>. Although the WebLogic API contains the "weblogic.rmi" API, it is deprecated and is only provided as a compatibility API. Other WebLogic APIs provided for compatibility are:

- `weblogic.rmi.registry`
- `weblogic.rmi.server`
- `weblogic.rmi.extensions`

10.2 Use PortableRemoteObject

To maintain code portability, always use `PortableRemoteObject` when casting the home interfaces. For example:

```
Propshome home = (Propshome)
PortableRemoteObject.narrow(
ctx.lookup( "Props" ),
Propshome.class );
```

10.3 Use WebLogic Work Areas

A best practice is to use Work Areas:

- Work Contexts allow Java EE developers to define properties as application context which implicitly flow across remote requests and allow downstream components to work in the context of the invoking client. Work Contexts allow

developers to pass properties without including them in a remote call. A Work Context is propagated with each remote call—allowing the called component to add or modify properties defined in the Work Context; similarly, the calling component can access the Work Context to obtain new or updated properties.

- Work Contexts ease the processing of implementing and maintaining functionality that requires that information to be passed to remote components, such as diagnostics monitoring, application transactions, and application load-balancing. Work Contexts are also a useful mechanism for providing information to third-party components.
- Work Contexts can propagate user-defined properties across all request scopes supported by WebLogic Server—a Work Context is available to all of the objects that can exist within the request scope, including RMI calls. For more information, see *Developing Applications for Oracle WebLogic Server*.

10.4 How to Handle Changes in Security Context

WLS RMI does not carry forward the security context in the stub. The thread that establishes the stub has the right subject in its thread context. If the stub is later used in a different thread or the stub is used after the current thread context has changed as a result of some operations, subsequent calls using the stub may fail with `SecurityException`. Operations that can change the context of a thread include establishing a new initial context and running WLST programmatically. Thread context changes often surface as cross-domain security issues when using JMS, JTA, and MDBs in multi-domain configurations.

If an RMI stub is going to be used in a different thread, the application can use a JSR-237 work manager to schedule the new thread in the thread context that the stub is created so that the thread context is propagated to the new thread. For cases where this is not possible, or cases where the context of the original thread changes somehow, the application should reestablish the context under which the stub should be invoked with JAAS. The following public APIs can be used to reestablish the security context:

- `weblogic.security.Security.getCurrentSubject()`—obtain the current object on the thread.
- `weblogic.security.Security.runAs()`—resume the subject.

10.5 Guidelines on Using the RMI Timeout

This feature provides a work around for legacy systems where the behavior of asynchronous calls is desired but not yet implemented. Oracle recommends legacy systems implement more appropriate technologies if possible, such as:

- Asynchronous RMI invocations
- JMS and Message Driven Beans (MDBs)
- HTTP servlet applications

If you need to use the RMI timeout for a legacy system, review the following guidelines:

- The RMI timeout should be used only when the following three conditions are met:
 - The method call is idempotent or does not introduce any state change
 - The method call is non-transactional

- No JMS resources are involved in the call
- There is no transparent failover to another cluster node when a request times out. `RequestTimeoutException` is always propagated to the caller.
- The server continues to process requests that have timed out. The client is required check the state of the request on the server before reattempting the call.
- If a server times out, the client has the ability to mark the server as unreachable in the client side cluster reference. This prevents calls from being directed to the marked server for a specified time.

CORBA Support for WebLogic Server

This chapter provides the official specifications for CORBA support for this release of WebLogic Server.

- [Section A.1, "Specification References"](#)
- [Section A.2, "Supported Specification Details"](#)
- [Section A.3, "Tools"](#)

A.1 Specification References

In general, this release of WebLogic Server adheres to the OMG specifications required by Java EE 1.4. For this release, the WebLogic ORB is compliant with following specification references:

- *CORBA 2.6: formal/01-12-01* at <http://www.omg.org/cgi-bin/doc?formal/01-12-01>
- *CORBA 2.3.1: formal/99-10-07* at <http://www.omg.org/cgi-bin/doc?formal/99-10-07>
- *IDL to Java language mapping: ptc/03-09-04* at <http://www.omg.org/cgi-bin/doc?ptc/03-09-04>
- *Revised IDL to Java language mapping 1.3: formal/00-11-03* at <http://www.omg.org/cgi-bin/doc?formal/00-11-03>
- *Java to IDL language mapping: ptc/00-01-06* at <http://www.omg.org/cgi-bin/doc?ptc/00-01-06>
- *Interoperable Naming Service: ptc/00-08-07* at <http://www.omg.org/cgi-bin/doc?ptc/00-08-07>
- *Transaction Service 1.2.1: formal/2001-11-03* at <http://www.omg.org/cgi-bin/doc?formal/2001-11-03>

Note: If the above links do not take you to the referenced specification, the OMG may have changed the URL. You can search <http://www.omg.org> for the correct specification.

A.2 Supported Specification Details

Not all of the above specifications are implemented in the WebLogic ORB in this release. The following section provides a precise list of the supported specifications by chapter or section:

- CORBA 2.6, chapters 1-3, 6-7, 13 and 15.
- Revised IDL to Java language mapping, section 1.21.8.2, the orb.properties file.
- CORBA 2.6, chapter 4 and 5, excepting details relevant to excluded features from other chapters, such as PortableInterceptors.
- CORBA 2.6, sections 10.6.1 and 10.6.2 are supported for repository IDs.
- CORBA 2.6, section 10.7 for TypeCode APIs.
- CORBA 2.6, chapter 11, Portable Object Adapter (POA) excepting details relevant to excluded features from other chapters, such as PortableInterceptors.
- CORBA 2.6, chapter 26, conformance level 0 plus stateful.
- The Interoperable Naming Service.
- Section 1.21.8 of the Revised IDL to Java Language Mapping Specification (ptc/00-11-03) has been changed from the version in the IDL to Java Language Mapping Specification (ptc/00-01-08).
- Transaction Service 1.2.1, as defined by the EJB 2.1 specification.

A.3 Tools

For this release, the WebLogic ORB is compliant with the following tools:

- The IDL to Java compiler (`idlj`) is the one that comes bundled with Java SE 5.0 and is compliant with following specification references:
 - CORBA 2.3.1, chapter 3 (IDL definition).
 - CORBA 2.3.1, chapters 5 and 6 (semantics of Value types).
 - CORBA 2.3.1, section 10.6.5 (pragmas).
 - The IDL to Java mapping specification.
 - The Revised IDL to Java language mapping specification section 1.12.1 (local interfaces).
- The Java to IDL compiler (the IIOP backend for `rmic`) complies with:
 - CORBA 2.6, chapters 5 and 6 (value types).
 - The Java to IDL language mapping. Note that this implicitly references section 1.21 of the IDL to Java language mapping.
 - IDL generated by the `-idl` flag complies with CORBA 2.6 chapter 3.