Oracle® Fusion Middleware
Developing JAX-WS Web Services for Oracle WebLogic Server
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Documentation for software developers that describes how to develop Java EE web services using the Java API for XML-based Web services (JAX-WS).
4 Programming the JWS File

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This preface describes the document accessibility features and conventions used in this guide—Developing JAX-WS Web Services for Oracle WebLogic Server.

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Conventions
The following text conventions are used in this document:

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<tr>
<th>Convention</th>
<th>Meaning</th>
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<tbody>
<tr>
<td><strong>boldface</strong></td>
<td>Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.</td>
</tr>
<tr>
<td><em>italic</em></td>
<td>Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.</td>
</tr>
<tr>
<td><code>monospace</code></td>
<td>Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.</td>
</tr>
</tbody>
</table>
What's New in This Guide

The following topics introduce the new and changed features of WebLogic Java API for XML Web Services (JAX-WS) Web services in Oracle Fusion Middleware 12c (12.2.1), and provides pointers to additional information.

New and Changed Features for 12c (12.2.1)

Oracle Fusion Middleware 12c (12.2.1) does not contain any new and changed features for this document.

New and Changed Features for 12c (12.1.3)

Oracle Fusion Middleware 12c (12.1.3) does not contain any new and changed features for this document.

New and Changed Features for 12c (12.1.2)

Oracle Fusion Middleware 12c (12.1.2) includes the following new and changed features for this document:

- Fast Infoset, a compressed binary encoding format that provides a more efficient serialization than the text-based XML format. Fast Infoset optimizes both document size and processing performance. See: Chapter 16, "Optimizing XML Transmission Using Fast Infoset".

- SOAP over Java Messaging Service (JMS) transport as a connection protocol option, enabling web services and clients to communicate using JMS destinations instead of HTTP connections. See Chapter 17, "Using SOAP Over JMS Transport".

- New standalone web service client JAR files that support basic JAX-WS client-side functionality and Oracle Web Services Manager (OWSM) security policy support. See Section 8.3, "Invoking a Web Service from a Standalone Java SE Client.".

- Enhanced Web Services Test Client for testing advanced features of web services. See Section 32.1, "Testing Web Services."

- The contents of the following guides, delivered in Oracle Fusion Middleware Release 11g, have been merged into this single document:
  - Getting Started With JAX-WS Web Services for Oracle WebLogic Server
  - Programming Advanced Features of JAX-WS Web Services for Oracle WebLogic Server
Part I introduces developing WebLogic (Java EE) web services using the Java API for XML-based Web services (JAX-WS).

Sections include:

- Chapter 1, "Introduction to JAX-WS Web Services"
- Chapter 2, "Examples for JAX-WS Web Service Developers"
1 Introduction to JAX-WS Web Services

This chapter provides an overview of developing WebLogic (Java EE) web services using the Java API for XML-based Web Services (JAX-WS). JAX-WS is a standards-based API for coding, assembling, and deploying Java web services.

This chapter includes the following sections:

■ Overview of JAX-WS Web Service Development
■ Roadmap for Implementing JAX-WS Web Services

For definitions of unfamiliar terms found in this and other books, see the Glossary.

1.1 Overview of JAX-WS Web Service Development

WebLogic web services are implemented according to the JSR 109: Implementing Enterprise Web Services specification (http://www.jcp.org/en/jsr/detail?id=109), which defines the standard Java EE runtime architecture for implementing web services in Java. The specification also describes a standard Java EE web service packaging format, deployment model, and runtime services, all of which are implemented by WebLogic web services.

The following sections describe:

■ Section 1.1.1, "The Programming Model—Metadata Annotations"
■ Section 1.1.2, "The Development Model—Bottom-up and Top-down"

1.1.1 The Programming Model—Metadata Annotations

The JSR 109: Implementing Enterprise Web Services specification (http://www.jcp.org/en/jsr/detail?id=109) describes that a Java EE web service is implemented by one of the following components:

■ A Java class running in the Web container.
■ A stateless or singleton session EJB running in the EJB container.

The code in the Java class or EJB implements the business logic of your web service. Oracle recommends that, instead of coding the raw Java class or EJB directly, you use the JWS annotations programming model, which makes programming a WebLogic web service much easier.

This programing model takes advantage of the JDK metadata annotations feature in which you create an annotated Java file and then use Ant tasks to compile the file into a Java class and generate all the associated artifacts. The Java Web Service (JWS) annotated file is the core of your web service. It contains the Java code that determines how your web service behaves. A JWS file is an ordinary Java class file that uses...
The JWS annotations you can use in a JWS file include the standard ones defined by the Web Services Metadata for the Java Platform specification (http://www.jcp.org/en/jsr/detail?id=181) as well as a set of other standard or WebLogic-specific annotations, depending on the type of web service you are creating.

Once you have coded the basic WebLogic web service, you can program and configure additional advanced features. For example, you can specify that the SOAP messages be digitally signed and encrypted (as specified by the WS-Security specification at http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss). You configure these more advanced features of WebLogic web services using WS-Policy files, which is an XML file that adheres to the WS-Policy specification and contains security-specific or web service reliable messaging-specific XML elements that describe the security and reliable-messaging configuration, respectively.

1.1.2 The Development Model—Bottom-up and Top-down

There are two approaches to web service development: bottom-up and top-down. Each approach is described in the following sections.

1.1.2.1 Bottom-up Approach: Starting from Java

In the bottom-up approach, you develop your the JWS file from scratch. After you create the JWS file, you use the jwsc WebLogic web service Ant task to compile the JWS file, as described by the JSR 109: Implementing Enterprise Web Services specification at http://www.jcp.org/en/jsr/detail?id=109.

The jwsc Ant task always compiles the JWS file into a plain Java class; the only time it implements a stateless or singleton session EJB is if you implement a stateless or singleton session EJB in your JWS file. The jwsc Ant task also generates all the supporting artifacts for the web service, packages everything into an archive file, and creates an Enterprise Application that you can then deploy to WebLogic Server.

By default, the jwsc Ant task packages the web service in a standard Web application WAR file with all the standard WAR artifacts. The WAR file, however, contains additional artifacts to indicate that it is also a web service; these additional artifacts include deployment descriptor files, the WSDL file that describes the public contract of the web service, and so on. If you execute jwsc against more than one JWS file, you can choose whether jwsc packages the web services in a single WAR file or each web service in a separate WAR file. In either case, jwsc generates a single Enterprise Application.

If you implement a stateless or singleton session EJB in your JWS file, then the jwsc Ant task packages the web service in a standard EJB JAR with all the usual artifacts, such as the ejb-jar.xml and weblogic-ejb.jar.xml deployment descriptor files. The EJB JAR file also contains additional web service-specific artifacts, as described in the preceding paragraph, to indicate that it is a web service. Similarly, you can choose whether multiple JWS files are packaged in a single or multiple EJB JAR files.

Alternatively, you can specify that your session EJB be packaged as a Web application WAR file by updating the jwsc Ant task in your build.xml file to enable the ejbWsInWar attribute in the module child element. For more information, see "jwsc" in WebLogic Web Services Reference for Oracle WebLogic Server.

For more information about the bottom-up approach, see Section 3.3, "Developing WebLogic Web Services Starting From Java: Main Steps."
1.1.2.2 Top-down Approach: Starting from WSDL

In the top-down approach, you create the web service from a WSDL file. You can use the `wsdlc` Ant task to generate a partial implementation of the web service described by the WSDL file. The `wsdlc` Ant task generates the JWS service endpoint interface (SEI), the stubbed-out JWS class file, JavaBeans that represent the XML Schema data types, and so on, into output directories.

After running the `wsdlc` Ant task, (which typically you only do once) you update the generated JWS implementation file, for example, to add Java code to the methods so that they function as defined by your business requirements. The generated JWS implementation file does not initially contain any business logic because the `wsdlc` Ant task does not know how you want your web service to function, although it does know the shape of the web service, based on the WSDL file.

The `wsdlc` Ant task packages the JWS SEI and data binding artifacts together into a JAR file that you later specify to the `jwsc` Ant task. You never need to update this JAR file; the only file you update is the JWS implementation class.

For more information about the top-down approach, see Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps."

1.2 Roadmap for Implementing JAX-WS Web Services

The following table provides a roadmap of common tasks for developing, packaging and deploying, invoking, and administering JAX-WS web services and clients using WebLogic Server.

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<td>Develop WebLogic web service clients using JAX-WS and apply best practices.</td>
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<td>Part III, &quot;Developing Basic JAX-WS Web Service Clients&quot;</td>
<td>Develop advanced features of WebLogic web services using JAX-WS. Advanced features include asynchronous clients, reliable messaging, atomic transactions, and so on. Test and monitor web services.</td>
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<td>Part IV, &quot;Developing Advanced Features of JAX-WS Web Services&quot;</td>
<td>Use pre-packaged WS-Policy files for web services reliable messaging and Make Connection, use batch reliable messaging, and migrate JAX-RPC web services and clients to JAX-WS.</td>
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</table>

**Note:** The JAX-WS implementation in Oracle WebLogic Server is extended from the JAX-WS Reference Implementation (RI) developed by the Glassfish Community (see http://jax-ws.java.net/). All features defined in the JAX-WS specification (JSR-224) are fully supported by Oracle WebLogic Server.

The JAX-WS RI also contains a variety of extensions, provided by Glassfish contributors. Unless specifically documented, JAX-WS RI extensions are not supported for use in Oracle WebLogic Server.

For an overview of WebLogic web services, standards, samples, and related documentation, see Understanding WebLogic Web Services for Oracle WebLogic Server. For
information about WebLogic web service security, see *Securing Web Services and Managing Policies with Oracle Web Services Manager* and *Securing WebLogic Web Services for Oracle WebLogic Server*. 
Examples for JAX-WS Web Service Developers

This chapter summarizes the examples for developing WebLogic web services using the Java API for XML-based Web services (JAX-WS).

Table 2–1 Examples for JAX-WS Web Service Developers

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Part II describes how to develop basic WebLogic web services using Java API for XML-based Web Services (JAX-WS).

Sections include:

- Chapter 3, "Developing JAX-WS Web Services"
- Chapter 4, "Programming the JWS File"
- Chapter 5, "Using JAXB Data Binding"
- Chapter 6, "Examples of Developing JAX-WS Web Services"
This chapter describes the iterative development process for WebLogic web services using Java API for XML-based Web Services (JAX-WS).

This chapter includes the following topics:

- Section 3.1, "Overview of the WebLogic Web Service Programming Model"
- Section 3.2, "Configuring Your Domain For Advanced Web Services Features"
- Section 3.3, "Developing WebLogic Web Services Starting From Java: Main Steps"
- Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps"
- Section 3.5, "Creating the Basic Ant build.xml File"
- Section 3.6, "Running the jwsc WebLogic Web Services Ant Task"
- Section 3.7, "Running the wsdlc WebLogic Web Services Ant Task"
- Section 3.8, "Updating the Stubbed-out JWS Implementation Class File Generated By wsdlc"
- Section 3.9, "Deploying and Undeploying WebLogic Web Services"
- Section 3.10, "Browsing to the WSDL of the Web Service"
- Section 3.11, "Configuring the Server Address Specified in the Dynamic WSDL"
- Section 3.12, "Testing the Web Service"
- Section 3.13, "Integrating Web Services Into the WebLogic Split Development Directory Environment"

3.1 Overview of the WebLogic Web Service Programming Model

The WebLogic web services programming model centers around JWS files—Java files that use JWS annotations to specify the shape and behavior of the web service—and Ant tasks that execute on the JWS file. JWS annotations are based on the metadata feature, introduced in Version 5.0 of the JDK (specified by JSR-175 at http://www.jcp.org/en/jsr/detail?id=175) and include standard annotations defined by Web Services Metadata for the Java Platform specification (JSR-181), described at http://www.jcp.org/en/jsr/detail?id=181, the JAX-WS specification (JSR-224), described at http://jax-ws.java.net, as well as additional ones. For a complete list of JWS annotations that are supported, see "Web Service Annotation Support" in WebLogic Web Services Reference for Oracle WebLogic Server. For additional detailed information about this programming model, see Section 1.1.1, "The Programming Model—Metadata Annotations."
Web services can be created using two development methods: bottom-up or top-down. Bottom-up development refers to the process of developing a web service from the underlying Java implementation using SOAP. Top-development describes the development of a web service from the WSDL source.

The following sections describe the high-level steps for iteratively developing a web service, either starting from Java (bottom-up) or starting from an existing WSDL file (top-down):

- Section 3.3, "Developing WebLogic Web Services Starting From Java: Main Steps"
- Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps"

Iterative development refers to setting up your development environment in such a way so that you can repeatedly code, compile, package, deploy, and test a web service until it works as you want. The WebLogic web service programming model uses Ant tasks to perform most of the steps of the iterative development process. Typically, you create a single `build.xml` file that contains targets for all the steps, then repeatedly run the targets, after you have updated your JWS file with new Java code, to test that the updates work as you expect.

In addition to the command-line tools described in this section, you can use an IDE, such as Oracle JDeveloper or Oracle Enterprise Pack for Eclipse (OEPE), to develop web services. For more information, see "Using Oracle IDEs to Build Web Services" in Understanding WebLogic Web Services for Oracle WebLogic Server.

### 3.2 Configuring Your Domain For Advanced Web Services Features

When creating or extending a domain, you can apply the WebLogic Advanced Web Services for JAX-WS Extension template (`wls_webservice_jaxws.jar`) to configure automatically the resources required to support the following advanced web service features:

- Asynchronous messaging, as described in Chapter 12, "Developing Asynchronous Clients."
- Web services reliable messaging, as described in Chapter 14, "Using Web Services Reliable Messaging."
- Message buffering, as described in Chapter 22, "Configuring Message Buffering for Web Services."

#### Note: To configure your domain for SOAP over JMS transport, see Section 17.2, "Configuring the WebLogic Server Domain for JMS Transport."

Use of the WebLogic Advanced Web Services for JAX-WS Extension template is only required when you need to ensure recoverability of advanced web services. The extension template configures the following resources that support recoverability by enabling WebLogic Server to retain critical state information in the event of a server failure:

- JMS queues for storing reliable messaging requests.
Default web service persistence configuration that provides a built-in, high-performance storage solution for web services.

The benefits of using the WebLogic Advanced Web Services for JAX-WS Extension template include:

- Web services and clients, by default, use the reliable and high performance WebLogic storage solution.
- Web services that use reliable messaging can buffer incoming asynchronous requests to increase fault tolerance and better absorb load. (This feature is enabled by default.)
- Messages between web services and clients can be configured such that they are fault-tolerant and recoverable in the event of a client failure, service failure, or both.

If you do not use the WebLogic Advanced Web Services for JAX-WS Extension template, you can still develop using the advanced features, but with a reduced quality of service, as describe below:

- By default, the state of an advanced web service is stored in memory; in the event of server failure, the data will be lost.
- Web services will not buffer incoming asynchronous requests when using reliable messaging.
- Web services and clients will not be recoverable in the event of a failure; any in-flight requests between them will be lost.

For more information, see Section 3.2.1, "Resources Required by Advanced Web Service Features."

---

**Note:** If you do not apply the WebLogic Advanced Web Services for JAX-WS Extension template to support recoverability:

- You must ensure that buffering is disabled for web services reliable messaging on the destination server. For more information, see Section 14.7.8, "Configuring a Non-buffered Destination for a Web Service."
- Quality of service features that you have configured for your web service may not be in effect. In this case, a message will be logged to the server log to indicate the feature has been disabled.

Although use of this extension template is not required, it makes the configuration of the required resources much easier. Alternatively, you can manually configure the resources required for these advanced features using the Oracle WebLogic Server Administration Console or WLST.

The following procedures describe how to configure a domain automatically for the advanced web services features. For more detailed instructions about using the Configuration Wizard to create and update WebLogic Server domains, see Creating WebLogic Domains Using the Configuration Wizard.

- Section 3.2.1, "Resources Required by Advanced Web Service Features"
- Section 3.2.2, "Scripts for Extending a Domain for Advanced Web Service Features"
- Section 3.2.3, "Configuring a Domain for Advanced Web Service Features Using the Configuration Wizard"
3.2.1 Resources Required by Advanced Web Service Features

Table 3–1 lists the resources that are defined automatically when using the WebLogic Advanced Web Services for JAX-WS Extension template.

If you do not apply the extension template, you need to configure the resources manually using the Oracle WebLogic Server Administration Console or WLST. Be sure to configure JMS targeting according to best practices defined in "Best Practices for JMS Beginners and Advanced Users" in Administering JMS Resources for Oracle WebLogic Server. Specifically:

- Configure a JMS server, Store-and-forward (SAF) service agent, and persistent store on each WebLogic Server. In a cluster, target each to a local migratable target (not the server). The host server's "default migratable target" is sufficient in most cases.
- Target JMS modules to a cluster (or single server if not using a clustered environment).
- Create exactly one subdeployment per module, and populate the subdeployment with the applicable JMS servers or SAF agents only, not the servers.
- Target JMS destinations to the subdeployment (referred to as Advanced Targeting in the WebLogic Server Administration Console). JMS destinations must never use the default targeting option.

The following variables are used in the table:

- `server_designator` specifies an ID that is generated automatically by the configuration framework. Typically, this ID is of the format `auto_number`.
- `uniqueID` specifies unique numeric ID that is generated automatically by the configuration framework. Typically, this ID is a numeric value, such as `1234`.
- `server_name` specifies the user-specified name of the server.

---

Note: At runtime, you should not change the name of resources; otherwise, you may experience runtime errors or data loss.
### Resources Required by Advanced Web Services Features

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WseeJaxwsJmsModule</td>
<td>JMS Module</td>
<td>Defines a JMS module that defines the JMS resources needed for advanced web services. All associated targets will be used to support JAX-WS web services. All servers to which this module is targeted must have the proper web services resources configured. Oracle recommends that you target this module to <strong>all</strong> servers in the domain. <strong>Note:</strong> You must configure the JMS module as a Uniform Distributed Destination (UDD). Any queues that are used by web services on JAX-WS must be Uniform Distributed Queues. Otherwise, an exception is thrown. To configure distributed destinations manually and for more information, see &quot;Using Distributed Destination&quot; in <em>Developing JMS Applications for Oracle WebLogic Server</em>.</td>
</tr>
<tr>
<td>WseeJaxwsFileStore_server_designator</td>
<td>File store</td>
<td>Specifies the file store, or physical store, used by the WebLogic Server to handle the I/O operations to save and retrieve data from the physical storage (such as file, DBMS, and so on). A separate file store is configured on each Managed Server targeted by the WseeJaxwsJmsModule, as specified by <em>server_designator</em>. In a single server domain, the file store is named WseeJaxwsFileStore. <strong>Note:</strong> Oracle recommends targeting the file store to a migratable target. To configure the file stores manually, see <em>Administering the WebLogic Persistent Store</em>.</td>
</tr>
</tbody>
</table>
| WseeJaxwsJmsServer_server_designator | JMS server    | Specifies the JMS server management container. A separate JMS Server is configured on each Managed Server targeted by WseeJaxwsJmsModule, as specified by *server_designator*. The JMS server uses WseeFileStore_server_designator as the file store. When configuring the JMS server, Oracle recommends the following: 
  * Target the JMS server to a migratable target. 
  * Set realistic quotas on each JMS server. For more information, see "Tuning WebLogic JMS" in *Tuning Performance of Oracle WebLogic Server*. To configure the JMS server manually, see "JMS Configuration" in *Administering JMS Resources for Oracle WebLogic Server*. |
| WseeJaxwsJmsServerunique ID          | JMS subdeployment | Specifies the JMS subdeployment targeting the JMS servers defined on all Managed Servers in the cluster. To configure the JMS subdeployment manually, see "Configure subdeployments in JMS system modules" in *Oracle WebLogic Server Administration Console Online Help*. |
DispatchPolicy

Work Manager Enables an application to execute multiple work items concurrently within a container. One Work Manager is generated for the domain and targeted to all servers to which the WseeJaxwsJmsModule is targeted.

Note: You should not change the name of the Work Manager resource.

To configure Work Managers manually, see "Description of the Work Manager API" in Developing CommonJ Applications for Oracle WebLogic Server.

ReliableWseeJaxwsSAFAgent_server_name SAF service agent Provides highly available JMS message production. A separate SAF agent is configured on each Managed Server, as specified by server_name. The SAF agent uses WseeFileStore_server_name as the file store.

In a single server domain, the SAF agent is named ReliableWseeJaxwsSAFAgent.

When configuring the SAF agent, Oracle recommends that you set realistic quotas on each JMS server. For more information, see "Tuning WebLogic JMS" in Tuning Performance of Oracle WebLogic Server.

To configure SAF service agents, see "Understanding the Store-and-Forward Service" in Administering the Store-and-Forward Service for Oracle WebLogic Server.

WseeBufferedRequestQueue_server_designator JMS queue Specifies the queue used for buffered requests. A separate queue is configured on each Managed Server, as specified by server_name.

In a single server domain, the queue is named WseeBufferedRequestQueue. In a clustered domain, each JMS queue is prefixed by dist_.

To configure the queues manually, see "Configure queues" in Oracle WebLogic Server Administration Console Online Help.

WseeBufferedRequestErrorQueue_server_designator JMS queue Specifies the error queue used for WseeBufferedRequestQueue for buffered requests that cannot be processed within the maximum number of retries. A separate queue is configured on each Managed Server, as specified by server_name.

In a single server domain, the queue is named WseeBufferedRequestErrorQueue. In a clustered domain, each JMS queue is prefixed by dist_.

To configure the queues manually, see "Configure queues" in Oracle WebLogic Server Administration Console Online Help.

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>weblogic.wsee.jaxws mdb. DispatchPolicy</td>
<td>Work Manager</td>
<td>Enables an application to execute multiple work items concurrently within a container. One Work Manager is generated for the domain and targeted to all servers to which the WseeJaxwsJmsModule is targeted.</td>
</tr>
<tr>
<td>ReliableWseeJaxwsSAFAgent_server_name</td>
<td>SAF service agent</td>
<td>Provides highly available JMS message production. A separate SAF agent is configured on each Managed Server, as specified by server_name. The SAF agent uses WseeFileStore_server_name as the file store.</td>
</tr>
<tr>
<td>WseeBufferedRequestQueue_server_designator</td>
<td>JMS queue</td>
<td>Specifies the queue used for buffered requests. A separate queue is configured on each Managed Server, as specified by server_name.</td>
</tr>
<tr>
<td>WseeBufferedRequestErrorQueue_server_designator</td>
<td>JMS queue</td>
<td>Specifies the error queue used for WseeBufferedRequestQueue for buffered requests that cannot be processed within the maximum number of retries. A separate queue is configured on each Managed Server, as specified by server_name.</td>
</tr>
</tbody>
</table>
3.2.2 Scripts for Extending a Domain for Advanced Web Service Features

The WebLogic Advanced Web Services for JAX-WS Extension template (wls_webservice_jaxws.jar) JAR file includes the following two Python scripts to assist you when extending an existing domain to use the WebLogic Advanced Web Services for JAX-WS Extension template.

**Note:** Before running either script, you need to ensure that the JMS Module is targeted to all servers in the domain.

### Table 3-2 Scripts for Extending a Domain for Advanced Web Service Features

<table>
<thead>
<tr>
<th>Script</th>
<th>Description</th>
</tr>
</thead>
</table>
| wls_webservice_complete_update_utils.py | Enables you to extend the domain using the extension template from within a WLST script. For more information and an example, see Section 3.2.4, "Using WLST to Extend a Domain With the Web Services Extension Template."
| wls_webservice_complete_update.py | Enables you to extend the domain using the extension template from the java command line. For example: `java weblogic.WLST -i wls_webservice_complete_update.py <domain-dir>`

### Table 3-1 Resources Required by Advanced Web Services Features (Cont.)

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WseeBufferedResponseQueue_server_designator</td>
<td>JMS queue</td>
<td>Specifies the queue used for buffered responses. A separate queue is configured on each Managed Server, as specified by server_designator. In a single server domain, the queue is named WseeBufferedResponseQueue. In a clustered domain, each JMS queue is prefixed by dist_. To configure the queues manually, see &quot;Configure queues&quot; in Oracle WebLogic Server Administration Console Online Help.</td>
</tr>
<tr>
<td>WseeBufferedResponseErrorQueue_server_designator</td>
<td>JMS queue</td>
<td>Specifies the error queue used for WseeBufferedResponseQueue for buffered responses that cannot be delivered within the maximum number of retries. A separate queue is configured on each Managed Server, as specified by server_designator. In a single server domain, the queue is named WseeBufferedResponseErrorQueue. In a clustered domain, each JMS queue is prefixed by dist_. To configure the queues manually, see &quot;Configure queues&quot; in Oracle WebLogic Server Administration Console Online Help.</td>
</tr>
<tr>
<td>WseeStore</td>
<td>Logical store</td>
<td>Defines the logical store. A separate logical store is configured on each Managed Server targeted by WseeJaxwsJmsModule. The logical store points to the WseeBufferedRequestQueue queue for its configuration and file store. To configure the logical store manually, see Section 21.3.1, &quot;Configuring the Logical Store.&quot;</td>
</tr>
</tbody>
</table>
3.2.3 Configuring a Domain for Advanced Web Service Features Using the Configuration Wizard

The following sections describe how to configure a domain for advanced web service features.

- Section 3.2.3.1, "Creating a Domain With the Web Services Extension Template"
- Section 3.2.3.2, "Extending a Domain With the Web Services Extension Template"

3.2.3.1 Creating a Domain With the Web Services Extension Template

To create a domain that is automatically configured for the advanced web service features:

1. Start the Configuration Wizard.
2. In the Welcome window, select Create a new WebLogic domain.
3. Click Next.
4. Select Generate a domain configured automatically to support the following products and select WebLogic Advanced Web Services for JAX-WS Extension.
5. Click Next.
6. Enter the name and location of the domain and click Next.
7. Configure the administrator user name and password and click Next.
8. Configure the server start mode and JDK and click Next.
9. To configure additional servers and clusters:
   a. On the Select Optional Configuration screen, at a minimum select Managed Servers, Clusters, and Machines to define the Managed Servers and clusters. Select any other items, as desired, and click Next.
   b. Configure the Managed Servers in your environment and click Next.
   c. Configure the clusters in your environment and click Next.
   d. Assign the managed servers to the clusters on the Assign to Clusters screen and click Next.
   e. Configure the machines in your environment and click Next.
   f. Target the services defined in the environment to clusters or servers on the Target Services to Clusters or Servers screen and click Next.
      Note: Target the WseeJaxwsJmsModule JMS module and weblogic.wsee.jaxws.mdb.DispatchPolicy Work Manager to all servers in the cluster.
      Servers targeted on this screen will be fully configured for use with advanced web services.
   g. Configure additional information on additional configuration screens (if selected in step 9a) and click Next.
10. When you reach the Configuration Summary screen, verify the domain details and click Create.

3.2.3.2 Extending a Domain With the Web Services Extension Template

To extend an existing domain so that it is automatically configured for these Web Services features:
1. Start the Configuration Wizard.
2. In the Welcome window, select **Extend an Existing WebLogic Domain**.
3. Click **Next**.
4. Select the domain to which you want to apply the extension template.
5. Click **Next**.
6. Select **Extend my domain automatically to support the following added products** and select **WebLogic Advanced Web Services for JAX-WS Extension**.
7. Click **Next**.
8. To configure additional servers and clusters:
   a. On the Select Optional Configuration screen, at a minimum select **Managed Servers, Clusters, and Machines** to define the Managed Servers and clusters. Select any other items, as desired, and click **Next**.
   b. Configure the Managed Servers in your environment and click **Next**.
   c. Configure the clusters in your environment and click **Next**.
   d. Assign the managed servers to the clusters on the Assign to Clusters screen and click **Next**.
   e. Configure the machines in your environment and click **Next**.
   f. Target the services defined in the environment to clusters or servers on the Target Services to Clusters or Servers screen and click **Next**.
      
      **Note**: Target the `WseeJaxwsJmsModule` JMS module and `weblogic.wsee.jaxws.mdb.DispatchPolicy` Work Manager to all servers in the cluster.
      
      Servers targeted on this screen will be fully configured for use with advanced web services.
   g. Configure additional information on additional configuration screens (if selected in step 9a) and click **Next**.
9. Verify that you are extending the correct domain, then click **Extend**.
10. Click **Done** to exit.

### 3.2.4 Using WLST to Extend a Domain With the Web Services Extension Template

The following provides an example of how to use WLST to extend a domain using the web services extension template. Specifically, this example demonstrates how to extend a single server domain. It is assumed that you have already created a single server domain. You can add additional servers and clusters to the domain in the location noted in the example script below.

After updating the script and executing it against your domain, all resources will be configured for advanced web service features.

Review the comments provided in the sample for more information. For more information about the WLST commands described, see the *Understanding the WebLogic Scripting Tool*. 
Example 3–1  WLST Script to Extend a Domain With the Web Services Extension Template

# Read the domain.
readDomain(single_server_domain_dir)

# Apply the template to the domain to configure the servers for advanced web service features.
installDir = install_directory/wlserver_10.3
templateLocation = installDir + '/common/templates/applications/wls_webservice_jaxws.jar'
addTemplate(templateLocation)

# Save and close the domain
updateDomain()
closeDomain()

# Read the domain
readDomain(domain_dir)

# Optionally create any servers and clusters required in your domain environment.
# <Include create calls here . . . >
# For example: create('server1','Server') or create('cluster1','Cluster')

# Optionally configure the JMS module as a Uniform Distributed Destination (Recommended)
setDistDestType('WseeJaxwsJmsModule', 'UDD')

# Target WseeJaxwsJmsModule to the desired servers and clusters.
assign('JMSSystemResource', 'WseeJaxwsJmsModule', 'Target', server_or_cluster)

# Repeat assign call for other servers and clusters in the environment.

# Unassign the resource from the Administration Server.
unassign('JMSSystemResource', 'WseeJaxwsJmsModule', 'Target', Administration_Server)

sys.path.append(domain_dir)

# Import the wls_webservice_complete_update_utils.py script. This script is added to the domain
directory when you extend the domain using the web services extension template.
import wls_webservice_complete_update_utils as update
update.doWseeFixup(globals())

# Save and close the domain
updateDomain()
closeDomain()

3.2.5 Updating Resources Added After Extending Your Domain

Once you have created or extended a domain using the WebLogic Advanced Web Services for JAX-WS Extension template, if you then modify the resources in your domain, you can update the configuration of those resources quickly and easily using the following WLST script.

After updating the script and executing it against your domain, all resources will be configured for advanced web service features.
Configuring Your Domain For Advanced Web Services Features

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**Note:** The wls_webservice_complete_update_utils.py script used at the end of this example is added to the domain directory when you extend the domain using the web services extension template.

---

Review the comments provided in the sample for more information. For more information about the WLST commands described, see the *Understanding the WebLogic Scripting Tool*.

### Example 3–2  WLST Script for Updating Resources Added After Extending Your Domain

```
# Read the domain.
readDomain(domain_dir)

# Optionally configure the JMS module as a Uniform Distributed Destination (Recommended)
setDistDestType('WseeJaxwsJmsModule', 'UDD')

# Target WseeJaxwsJmsModule to the desired servers and clusters.
assign('JMSSystemResource', 'WseeJaxwsJmsModule', 'Target', server_or_cluster_name)
# Repeat assign call for other servers and clusters in the environment.

# Unassign the resource from the Administration Server.
unassign('JMSSystemResource', 'WseeJaxwsJmsModule', 'Target', Administration_Server_name)

sys.path.append(domain_dir)

# Import the wls_webservice_complete_update_utils.py script. This script is added to the domain
# directory when you extend the domain using the web services extension template.
import wls_webservice_complete_update_utils as update
update.doWseeFixup(globals())

# Save and close the domain.
updateDomain()
```

### 3.2.6  Troubleshooting Problems When Applying the WebLogic Advanced Web Services for JAX-WS Extension Template

When creating or extending a domain using the WebLogic Advanced Web Services for JAX-WS Extension template (`wls_webservice_jaxws.jar`), you may encounter an exception during the execution of the `final.py` script, similar to the following:

```
2011-02-24 15:36:26,730 WARN  [Thread-32]
com.oracle.cie.domain.script.ScriptExecutor - warn: set obj126 attribute
Targets to 'new_Cluster_1, new_Cluster_2, new_Cluster_3, new_Cluster_4,
new_Cluster_5, new_Cluster_6'
com.oracle.cie.domain.script.ScriptException: Unable to find attribute Targets
...
```

To work around this issue, perform the following steps:

1. Back up the following file to a directory other than `WL_HOME/common/templates/applications`:
   
   `WL_HOME/common/templates/applications/wls_webservice_jaxws.jar`

   For example, copy the file to `WL_HOME/common/templates/applications/backup`.

2. Remove the `script/final.py` file from the `WL_HOME/common/templates/applications/wls_webservice_jaxws.jar` file.
You can do this using a graphical tool, such as Winzip, or from the command line as follows:

- **a.** Make a temp directory under the `WL_HOME/common/templates/applications` directory.
- **b.** `cd` into the temp directory.
- **c.** Unjar the `WL_HOME/common/templates/applications/wls_webservice_jaxws.jar` file (the original copy). For example:
  
  ```bash
  jar -xvf ../wls_webservice_jaxws.jar
  ```

- **d.** Delete the `script/final.py` file from the directory.
- **e.** Delete the original JAR file. For example:
  
  ```bash
  rm ../wls_webservice_jaxws.jar
  ```

- **f.** Jar the `wls_webservice_jaxws.jar` file. For example:
  
  ```bash
  jar cvf ../wls_webservice_jaxws.jar *
  ```

3. Extend the domain using the extension template from the Java command line by performing the following steps:

- **a.** `cd` into the domain directory.
- **b.** Execute the `wls_webbservice_complete_update.py` script. For example:
  
  ```bash
  java weblogic.WLST -i wls_webbservice_complete_update.py .
  ```

  For more information about the `wls_webbservice_complete_update.py` script, see Section 3.2.2, "Scripts for Extending a Domain for Advanced Web Service Features."

### 3.3 Developing WebLogic Web Services Starting From Java: Main Steps

This section describes the general procedure for developing WebLogic web services starting from Java—in effect, coding the JWS file from scratch and later generating the WSDL file that describes the service. See Chapter 6, "Examples of Developing JAX-WS Web Services" for specific examples of this process.

The following procedure is just a recommendation; if you have set up your own development environment, you can use this procedure as a guide for updating your existing environment to develop WebLogic web services.

---

**Note:** This procedure does not use the WebLogic web services split development directory environment. If you are using this development environment, and would like to integrate web services development into it, see Section 3.13, "Integrating Web Services Into the WebLogic Split Development Directory Environment" for details.
### Table 3–3  Steps to Develop Web Services Starting From Java

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set up the environment.</td>
<td>Open a command window and execute the setDomainEnv.cmd (Windows) or setDomainEnv.sh (UNIX) command, located in the bin subdirectory of your domain directory. The default location of WebLogic Server domains is ORACLE_HOME/user_projects/domains/domainName, where ORACLE_HOME is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and domainName is the name of your domain.</td>
</tr>
<tr>
<td>2</td>
<td>Create a project directory.</td>
<td>The project directory will contain the JWS file, Java source for any user-defined data types, and the Ant build.xml file. You can name the project directory anything you want.</td>
</tr>
<tr>
<td>3</td>
<td>Create the JWS file that implements the web service.</td>
<td>See Chapter 4, &quot;Programming the JWS File.&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Create user-defined data types. (Optional)</td>
<td>If your web service uses user-defined data types, create the JavaBeans that describes them. See Section 4.6, &quot;Programming the User-Defined Java Data Type.&quot;</td>
</tr>
<tr>
<td>5</td>
<td>Create a basic Ant build file, build.xml.</td>
<td>See Section 3.5, &quot;Creating the Basic Ant build.xml File.&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Run the jwsc Ant task against the JWS file.</td>
<td>The jwsc Ant task generates source code, data binding artifacts, deployment descriptors, and so on, into an output directory. The jwsc Ant task generates an Enterprise application directory structure at this output directory; later you deploy this exploded directory to WebLogic Server as part of the iterative development process. See Section 3.6, &quot;Running the jwsc WebLogic Web Services Ant Task.&quot;</td>
</tr>
<tr>
<td>7</td>
<td>Deploy the web service to WebLogic Server.</td>
<td>See Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services.&quot;</td>
</tr>
<tr>
<td>8</td>
<td>Browse to the WSDL of the web service.</td>
<td>Browse to the WSDL of the web service to ensure that it was deployed correctly. See Section 3.10, &quot;Browsing to the WSDL of the Web Service.&quot;</td>
</tr>
<tr>
<td>9</td>
<td>Test the web service.</td>
<td>See Section 3.12, &quot;Testing the Web Service.&quot;</td>
</tr>
<tr>
<td>10</td>
<td>Edit the web service. (Optional)</td>
<td>To make changes to the web service, update the JWS file, undeploy the web service as described in Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services,&quot; then repeat the steps starting from running the jwsc Ant task (Step 6).</td>
</tr>
</tbody>
</table>

See Chapter 8, "Developing Web Service Clients" for information on writing client applications that invoke a web service.

### 3.4 Developing WebLogic Web Services Starting From a WSDL File: Main Steps

This section describes the general procedure for developing WebLogic web services based on an existing WSDL file. See Chapter 6, "Examples of Developing JAX-WS Web Services," for a specific example of this process.

The procedure is just a recommendation; if you have set up your own development environment, you can use this procedure as a guide for updating your existing environment to develop WebLogic web services.

It is assumed in this procedure that you already have an existing WSDL file.
Creating the Basic Ant build.xml File

Table 3–4  Steps to Develop Web Services Starting From Java

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set up the environment.</td>
<td>Open a command window and execute the <code>setDomainEnv.cmd</code> (Windows) or <code>setDomainEnv.sh</code> (UNIX) command, located in the bin subdirectory of your domain directory. The default location of WebLogic Server domains is <code>ORACLE_HOME/user_projects/domains/domainName</code>, where <code>ORACLE_HOME</code> is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and <code>domainName</code> is the name of your domain.</td>
</tr>
<tr>
<td>2</td>
<td>Create a project directory.</td>
<td>The project directory will contain the generated artifacts and the Ant build.xml file.</td>
</tr>
<tr>
<td>3</td>
<td>Create a basic Ant build file, build.xml.</td>
<td>See Section 3.5, &quot;Creating the Basic Ant build.xml File.&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Put your WSDL file in a directory that the build.xml Ant build file is able to read.</td>
<td>For example, you can put the WSDL file in a <code>wsdl_files</code> child directory of the project directory.</td>
</tr>
<tr>
<td>5</td>
<td>Run the <code>wsdlc</code> Ant task against the WSDL file.</td>
<td>The <code>wsdlc</code> Ant task generates the JWS service endpoint interface (SEI), the stubbed-out JWS class file, JavaBeans that represent the XML Schema data types, and so on, into output directories. See Section 3.7, &quot;Running the <code>wsdlc</code> WebLogic Web Services Ant Task.&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Update the stubbed-out JWS file generated by the <code>wsdlc</code> Ant task.</td>
<td>The <code>wsdlc</code> Ant task generates a stubbed-out JWS file. You need to add your business code to the web service so it behaves as you want. See Section 3.8, &quot;Updating the Stubbed-out JWS Implementation Class File Generated By <code>wsdlc</code>.&quot;</td>
</tr>
<tr>
<td>7</td>
<td>Run the <code>jwsc</code> Ant task against the JWS file.</td>
<td>Specify the artifacts generated by the <code>wsdlc</code> Ant task as well as your updated JWS implementation file, to generate an Enterprise Application that implements the web service. See Section 3.6, &quot;Running the <code>jwsc</code> WebLogic Web Services Ant Task.&quot;</td>
</tr>
<tr>
<td>8</td>
<td>Deploy the web service to WebLogic Server.</td>
<td>See Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services.&quot;</td>
</tr>
<tr>
<td>9</td>
<td>Browse to the WSDL of the web service.</td>
<td>Browse to the WSDL of the web service to ensure that it was deployed correctly. See Section 3.10, &quot;Browsing to the WSDL of the Web Service.&quot;</td>
</tr>
<tr>
<td>10</td>
<td>Test the web service.</td>
<td>See Section 3.12, &quot;Testing the Web Service.&quot;</td>
</tr>
<tr>
<td>11</td>
<td>Edit the web service. (Optional)</td>
<td>To make changes to the web service, update the JWS file, undeploy the web service as described in Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services,&quot; then repeat the steps starting from running the <code>jwsc</code> Ant task (Step 6).</td>
</tr>
</tbody>
</table>

See Chapter 8, "Developing Web Service Clients" for information on writing client applications that invoke a web service.

3.5 Creating the Basic Ant build.xml File

Ant uses build files written in XML (default name `build.xml`) that contain a `<project>` root element and one or more targets that specify different stages in the web services development process. Each target contains one or more tasks, or pieces of code that

3-14  Developing JAX-WS Web Services for Oracle WebLogic Server
can be executed. This section describes how to create a basic Ant build file; later sections describe how to add targets to the build file that specify how to execute various stages of the web services development process, such as running the jwsc Ant task to process a JWS file and deploying the web service to WebLogic Server.

The following skeleton build.xml file specifies a default all target that calls all other targets that will be added in later sections:

```xml
<project default="all">
  <target name='all' depends='clean,buidl-service,deploy' />
  <target name='clean'>
    <delete dir='output' />
  </target>
  <target name='build-service'>
    <!--add jwsc and related tasks here -->
  </target>
  <target name='deploy'>
    <!--add wldeploy task here -->
  </target>
</project>
```

For detailed information about how to integrate and use Ant tasks in your development environment to program a web service and a client application that invokes the web service, see:

- "Using Oracle WebLogic Server Ant Tasks" in Understanding WebLogic Web Services for Oracle WebLogic Server
- "Ant Task Reference" in WebLogic Web Services Reference for Oracle WebLogic Server
- The following sections in Developing Applications for Oracle WebLogic Server:
  - "Using Ant Tasks to Configure and Use a WebLogic Server Domain"
  - "wldeploy Ant Task Reference"

### 3.6 Running the jwsc WebLogic Web Services Ant Task

The jwsc Ant task takes as input a JWS file that contains JWS annotations and generates all the artifacts you need to create a WebLogic web service. The JWS file can be either one you coded yourself from scratch or one generated by the wsdlc Ant task.

The jwsc-generated artifacts include:

- JSR-109 web service class file.
- JAXB data binding artifact class file.
- All required deployment descriptors, including:
  - Servlet-based web service deployment descriptor file: web.xml.
  - Ear deployment descriptor files: application.xml and weblogic-application.xml.

**Note:** The WSDL file is generated when the service endpoint is deployed.

If you are running the jwsc Ant task against a JWS file generated by the wsdlc Ant task, the jwsc task does not generate these artifacts, because the wsdlc Ant task
already generated them for you and packaged them into a JAR file. In this case, you use an attribute of the \texttt{jwsc} Ant task to specify this \texttt{wsdlc}-generated JAR file.

After generating all the required artifacts, the \texttt{jwsc} Ant task compiles the Java files (including your JWS file), packages the compiled classes and generated artifacts into a deployable JAR archive file, and finally creates an exploded Enterprise Application directory that contains the JAR file.

The \texttt{jwsc} Ant task includes attributes and child elements that enable you to:

- Process multiple JWS files at once. You can choose to package each resulting web service into its own Web application WAR file, or group all of the web services into a single WAR file.
- Specify the transports (HTTP/HTTPS or JMS transport) that client applications can use when invoking the web service, as described Section 3.6.1, "Specifying the Transport Used to Invoke the Web Service."
- Update an existing Enterprise Application or Web application, rather than generate a completely new one.

To run the \texttt{jwsc} Ant task, add the following \texttt{taskdef} and \texttt{build-service} target to the \texttt{build.xml} file:

```xml
<taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />
<target name="build-service">
    <jwsc
        srcdir="src_directory"
        destdir="ear_directory">
        <jws file="JWS_file"
            compiledWsdl="WSDLC_Generated_JAR"
            type="WebService_type"/>
    </jwsc>
</target>
```

where:

- \texttt{ear_directory} refers to an Enterprise Application directory that will contain all the generated artifacts.
- \texttt{src_directory} refers to the top-level directory that contains subdirectories that correspond to the package name of your JWS file.
- \texttt{JWS_file} refers to the full pathname of your JWS file, relative to the value of the \texttt{src_directory} attribute.
- \texttt{WSDLC_Generated_JAR} refers to the JAR file generated by the \texttt{wsdlc} Ant task that contains the JWS SEI and data binding artifacts that correspond to an existing WSDL file.

\textbf{Note:} You specify this attribute only in the "starting from WSDL" use case; this procedure is described in Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps."

- \texttt{WebService_type} specifies the type of web service. This value can be set to JAXWS or JAXRPC.

The required \texttt{taskdef} element specifies the full class name of the \texttt{jwsc} Ant task.
Only the `srcdir` and `destdir` attributes of the `jwsc` Ant task are required. This means that, by default, it is assumed that Java files referenced by the JWS file (such as JavaBeans input parameters or user-defined exceptions) are in the same package as the JWS file. If this is not the case, use the `sourcepath` attribute to specify the top-level directory of these other Java files.

See “jwsc” in the WebLogic Web Services Reference for Oracle WebLogic Server for complete documentation and examples about the `jwsc` Ant task.

3.6.1 Specifying the Transport Used to Invoke the Web Service

The `<jws>` child element of `jwsc` includes the following optional child elements for specifying the transports (HTTP/S or JMS) that are used to invoke the web service:

- **WLHttpTransport**—Specifies the context path and service URI sections of the URL used to invoke the web service over the HTTP/S transport, as well as the name of the port in the generated WSDL. For more information, see “WLHttpTransport” in WebLogic Web Services Reference for Oracle WebLogic Server.

- **JmsTransportService**—Enables and configures SOAP over JMS transport. Optionally, you can configure the destination name, destination type, delivery mode, request and response queues, and other JMS transport properties. For more information, see Chapter 3, "Developing JAX-WS Web Services."

The following guidelines describe the usage of the transport elements for the `jwsc` Ant task:

- The transports you specify to `jwsc` always override any corresponding transport annotations in the JWS file. In addition, all attributes of the transport annotation are ignored, even if you have not explicitly specified the corresponding attribute for the transport element, in which case the default value of the transport element attribute is used.

- You can specify both transport elements for a particular JWS file. However, you can specify only one instance of a particular transport element. For example, although you cannot specify two different `<WLHttpTransport>` elements for a given JWS file, you can specify one `<WLHttpTransport>` and one `<WLJmsTransport>` element.

- The value of the `serviceURI` attribute can be the same when you specify both `<WLJmsTransport>` and `<WLHttpTransport>`.

- All transports associated with a particular JWS file must specify the same `contextPath` attribute value.

- If you specify more than one transport element for a particular JWS file, the value of the `portName` attribute for each element must be unique among all elements. This means that you must explicitly specify this attribute if you add more than one transport child element to `<jws>`, because the default value of the element will always be the same and thus cause an error when running the `jwsc` Ant task.

- If you do not specify any transport as either one of the transport elements to the `jwsc` Ant task or a transport annotation in the JWS file, then the web service's default URL corresponds to the default value of the `WLHttpTransport` element.

3.6.2 Defining the Context Path of a WebLogic Web Service

There are a variety of places where the context path (also called context root) of a WebLogic web service can be specified. This section describes how to determine which
is the true context path of the service based on its configuration, even if it is has been set in multiple places.

In the context of this discussion, a web service context path is the string that comes after the host:port portion of the web service URL. For example, if the deployed WSDL of a WebLogic web service is as follows:


The context path for this web service is financial.

The following list describes the order of precedence, from most to least important, of all possible context path specifications:

1. The contextPath attribute of the <module> element and <jws> element (when used as a direct child of the jwsc Ant task.)
2. The contextPath attribute of the <WLHttpTransport> child elements of <jws>.
3. The default value of the context path, which is the name of the JWS file without any extension.

Assume that you update the build.xml file and add a <WLHttpTransport> child element to the <jws> element that specifies the JWS file and set its contextPath attribute to finance. The context path of the web service would now be finance. If, however, you then group the <jws> element (including its child <WLHttpTransport> element) under a <module> element, and set its contextPath attribute to money, then the context path of the web service would now be money.

If you do not specify any contextPath attribute in either the JWS file or the jwsc Ant task, then the context path of the web service is the default value: the name of the JWS file without its *.java extension.

If you group two or more <jws> elements under a <module> element and do not set the context path using any of the other options listed above, then you must specify the contextPath attribute of <module> to specify the common context path used by all the web services in the module. Otherwise, the default context paths for all the web services in the module are going to be different (due to different names of the implementing JWS files), which is not allowed in a single WAR file.

### 3.6.3 Examples of Using jwsc

The following build.xml excerpt shows a basic example of running the jwsc Ant task on a JWS file:

```xml
<taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />
<target name="build-service">
    <jwsc
        srcdir="src"
        destdir="output/helloWorldEar">
        <jws
            file="examples/webservices/hello_world/HelloWorldImpl.java"
            type="JAXWS"/>
    </jwsc>
</target>
```

In the example:

- The Enterprise application will be generated, in exploded form, in output/helloWorldEar, relative to the current directory.
Running the wsdlc WebLogic Web Services Ant Task

The wsdlc Ant task takes as input a WSDL file and generates artifacts that together partially implement a WebLogic web service. These artifacts include:

- JWS service endpoint interface (SEI) that implements the web service described by the WSDL file.
- JWS implementation file that contains a partial (stubbed-out) implementation of the generated JWS SEI. This file must be customized by the developer.
- JAXB data binding artifacts.
- Optional Javadocs for the generated JWS SEI.

The wsdlc Ant task packages the JWS SEI and data binding artifacts together into a JAR file that you later specify to the jwsc Ant task. You never need to update this JAR file; the only file you update is the JWS implementation class.

To run the wsdlc Ant task, add the following taskdef and generate-from-wsdl targets to the build.xml file:

```xml
<taskdef name="wsdlc"
    classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
<target name="generate-from-wsdl">
    <wsdlc srcWsdl="WSDLFile"
           destJwsDir="JWS_interface_directory"
           destImplDir="JWSImplementation_directory"/>
</target>
```

### 3.7 Running the wsdlc WebLogic Web Services Ant Task

The wsdlc Ant task takes as input a WSDL file and generates artifacts that together partially implement a WebLogic web service. These artifacts include:

- JWS service endpoint interface (SEI) that implements the web service described by the WSDL file.
- JWS implementation file that contains a partial (stubbed-out) implementation of the generated JWS SEI. This file must be customized by the developer.
- JAXB data binding artifacts.
- Optional Javadocs for the generated JWS SEI.

The wsdlc Ant task packages the JWS SEI and data binding artifacts together into a JAR file that you later specify to the jwsc Ant task. You never need to update this JAR file; the only file you update is the JWS implementation class.

To run the wsdlc Ant task, add the following taskdef and generate-from-wsdl targets to the build.xml file:

```xml
<taskdef name="wsdlc"
    classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
<target name="generate-from-wsdl">
    <wsdlc srcWsdl="WSDLFile"
           destJwsDir="JWS_interface_directory"
           destImplDir="JWSImplementation_directory"/>
</target>
```
Running the wsdlc WebLogic Web Services Ant Task

```xml
<target name="generate-from-wsdl">
  <wsdlc
    srcWsdl="wsdl_files/TemperatureService.wsdl"
    destJwsDir="output/compiledWsdl"
    destImplDir="impl_output"
    packageName="examples.webservices.wsdlc"
    type="JAXWS" />
</target>
```

where:

- **WSDLFile** refers to the name of the WSDL file from which you want to generate a partial implementation, including its absolute or relative pathname.

- **JWS_interface_directory** refers to the directory into which the JAR file that contains the JWS SEI and data binding artifacts should be generated. The name of the generated JAR file is **WSDLFile_wsdl.jar**, where **WSDLFile** refers to the root name of the WSDL file. For example, if the name of the WSDL file you specify to the file attribute is **MyService.wsdl**, then the generated JAR file is **MyService_wsdl.jar**.

- **JWS_implementation_directory** refers to the top directory into which the stubbed-out JWS implementation file is generated. The file is generated into a subdirectory hierarchy corresponding to its package name. The name of the generated JWS file is **Service_PortTypeImpl.java**, where **Service** and **PortType** refer to the name attribute of the `<service>` element and its inner `<port>` element, respectively, in the WSDL file for which you are generating a web service. For example, if the service name is **MyService** and the port name is **MyServicePortType**, then the JWS implementation file is called **MyService_MyServicePortTypeImpl.java**.

- **Package_name** refers to the package into which the generated JWS SEI and implementation files should be generated. If you do not specify this attribute, the wsdlc Ant task generates a package name based on the **targetNamespace** of the WSDL.

- **WebService_type** specifies the type of web service. This value can be set to **JAXWS** or **JAXRPC**.

The required `taskdef` element specifies the full class name of the wsdlc Ant task. Only the `srcWsdl` and `destJwsDir` attributes of the wsdlc Ant task are required. Typically, however, you generate the stubbed-out JWS file to make your programming easier. Oracle recommends you explicitly specify the package name in case the **targetNamespace** of the WSDL file is not suitable to be converted into a readable package name.

The following `build.xml` excerpt shows an example of running the wsdlc Ant task against a WSDL file:

```xml
<taskdef name="wsdlc"
  classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
<target name="generate-from-wsdl">
  <wsdlc
    srcWsdl="wsdl_files/TemperatureService.wsdl"
    destJwsDir="output/compiledWsdl"
    destImplDir="impl_output"
    packageName="examples.webservices.wsdlc"
    type="JAXWS" />
</target>
```

In the example:

- The existing WSDL file is called **TemperatureService.wsdl** and is located in the `wsdl_files` subdirectory of the directory that contains the `build.xml` file.
3.8 Updating the Stubbed-out JWS Implementation Class File Generated By wsdlc

The wsdlc Ant task generates the stubbed-out JWS implementation file into the directory specified by its destImplDir attribute; the name of the file is Service_ PortTypeImpl.java, where Service is the name of the service and PortType is the name of the port type in the original WSDL. The class file includes everything you need to compile it into a web service, except for your own business logic.

The JWS class implements the JWS web service endpoint interface that corresponds to the WSDL file; the JWS SEI is also generated by wsdlc and is located in the JAR file that contains other artifacts, such as the Java representations of XML Schema data types in the WSDL and so on. The public methods of the JWS class correspond to the operations in the WSDL file.

The wsdlc Ant task automatically includes the @WebService annotation in the JWS implementation class; the value corresponds to the equivalent value in the WSDL. For example, the serviceName attribute of @WebService is the same as the name attribute of the <service> element in the WSDL file.

When you update the JWS file, you add Java code to the methods so that the corresponding web service operations operate as required. Typically, the generated JWS file contains comments where you should add code, such as:

//replace with your impl here

In addition, you can add additional JWS annotations to the file, with the following restrictions:

- You can include the following annotations from the standard (JSR-181) javax.jws package in the JWS implementation file: @WebService, @HandlerChain, @SOAPMessageHandler, and @SOAPMessageHandlers. If you specify any other JWS annotation from the javax.jws package, the jwsc Ant task returns error when you try to compile the JWS file into a web service. For example, if you specify the @Policy annotation in a your JWS implementation file, the jwsc Ant task throws a compilation error.

- You can specify only the serviceName, endpointInterface, and targetNamespace attributes of the @WebService annotation. Use the serviceName attribute to specify
Deploying and Undeploying WebLogic Web Services

A different `<service>` WSDL element from the one that the `wsdlc` Ant task used, in the rare case that the WSDL file contains more than one `<service>` element. Use the `endpointInterface` attribute to specify the JWS SEI generated by the `wsdlc` Ant task. Use the `targetNamespace` attribute to specify the namespace of a WSDL service, which can be different from the one in JWS SEI.

- You can specify JAX-WS—JSR 224, JAXB (JSR 222)—or Common (JSR 250) annotations, as required. For more information about the annotations that are supported, see "JWS Annotation Reference" in WebLogic Web Services Reference for Oracle WebLogic Server.

After you have updated the JWS file, Oracle recommends that you move it to an official source location, rather than leaving it in the `wsdlc` output directory.

The following example shows the `wsdlc`-generated JWS implementation file from the WSDL shown in Section 6.3.1, "Sample WSDL File"; the text in **bold** indicates where you would add Java code to implement the single operation (`getTemp`) of the web service:

```java
package examples.webservices.wsdlc;
import javax.jws.WebService;
/**
 * TemperaturePortTypeImpl class implements web service endpoint interface
 * TemperaturePortType */
@WebService(
    serviceName="TemperatureService",
    endpointInterface="examples.webservices.wsdlc.TemperaturePortType")
public class TemperaturePortTypeImpl implements TemperaturePortType {
    public TemperaturePortTypeImpl() {
    }
    public float getTemp(java.lang.String zipcode) {
        //replace with your impl here
        return 0;
    }
}
```

### 3.9 Deploying and Undeploying WebLogic Web Services

Because web services are packaged as Enterprise Applications, deploying a web service simply means deploying the corresponding EAR file or exploded directory.

There are a variety of ways to deploy WebLogic applications, from using the WebLogic Server Administration Console to using the `weblogic.Deployer` Java utility. There are also various issues you must consider when deploying an application to a production environment as opposed to a development environment. For a complete discussion about deployment, see Deploying Applications to Oracle WebLogic Server.

This guide, because of its development nature, discusses just two ways of deploying web services:

- Section 3.9.1, "Using the wldeploy Ant Task to Deploy Web Services"
- Section 3.9.2, "Using the Administration Console to Deploy Web Services"

#### 3.9.1 Using the wldeploy Ant Task to Deploy Web Services

The easiest way to deploy a web service as part of the iterative development process is to add a target that executes the `wldeploy` WebLogic Ant task to the same `build.xml`
file that contains the jwsc Ant task. You can add tasks to both deploy and undeploy
the web service so that as you add more Java code and regenerate the service, you can
redeploy and test it iteratively.

To use the wldeploy Ant task, add the following target to your build.xml file:

```xml
<target name="deploy">
  <wldeploy action="deploy"
    name="DeploymentName"
    source='Source' user='AdminUser'
    password='AdminPassword'
    adminurl='AdminServerURL'
    targets='ServerName'/>
</target>
```

where:

- **DeploymentName** refers to the deployment name of the Enterprise Application, or
  the name that appears in the WebLogic Server Administration Console under the
  list of deployments.
- **Source** refers to the name of the Enterprise Application EAR file or exploded
directory that is being deployed. By default, the jwsc Ant task generates an
exploded Enterprise Application directory.
- **AdminUser** refers to administrative username.
- **AdminPassword** refers to the administrative password.
- **AdminServerURL** refers to the URL of the Administration Server, typically
t3://localhost:7001.
- **ServerName** refers to the name of the WebLogic Server instance to which you are
deploying the web service.

For example, the following wldeploy task specifies that the Enterprise Application
exploded directory, located in the output/ComplexServiceEar directory relative to the
current directory, be deployed to the myServer WebLogic Server instance. Its deployed
name is ComplexServiceEar.

```xml
<target name="deploy">
  <wldeploy action="deploy"
    name='ComplexServiceEar'
    source='output/ComplexServiceEar' user='weblogic'
    password='weblogic' verbose='true'
    adminurl='t3://localhost:7001'
    targets='myserver'/>
</target>
```

To actually deploy the web service, execute the deploy target at the command-line:

```
prompt> ant deploy
```

You can also add a target to easily undeploy the web service so that you can make
changes to its source code, then redeploy it:

```xml
<target name="undeploy">
  <wldeploy action="undeploy"
    name='ComplexServiceEar'
    user='weblogic'
    password='weblogic' verbose='true'
    adminurl='t3://localhost:7001'
    targets='myserver'/>
</target>
```
When undeploying a web service, you do not specify the source attribute, but rather undeploy it by its name.

### 3.9.2 Using the Administration Console to Deploy Web Services

To use the WebLogic Server Administration Console to deploy the web service, first invoke it in your browser using the following URL:

http://[host]:[port]/console

where:

- **host** refers to the computer on which WebLogic Server is running.
- **port** refers to the port number on which WebLogic Server is listening (default value is 7001).

Then use the deployment assistants to help you deploy the Enterprise application. For more information on the WebLogic Server Administration Console, see the Oracle WebLogic Server Administration Console Online Help.

### 3.10 Browsing to the WSDL of the Web Service

You can display the WSDL of the web service in your browser to ensure that it has deployed correctly.

The following URL shows how to display the web service WSDL in your browser:

http://[host]:[port]/[contextPath]/[serviceUri]?WSDL

where:

- **host** refers to the computer on which WebLogic Server is running (for example, localhost).
- **port** refers to the port number on which WebLogic Server is listening (default value is 7001).
- **contextPath** refers to the context root of the web service. There are many places to set the context root (the <WLHttpTransport>, <module>, or <jws> element of jwsc) and certain methods take precedence over others. See "Defining the Context Path of a WebLogic Web Service" on page 3-17.
- **serviceUri** refers to the value of the serviceUri attribute of the <WLHttpTransport> child element of the jwsc Ant task. If you do not specify any serviceUri attribute in the jwsc Ant task, then the serviceUri of the web service is the default value: the serviceName element of the @WebService annotation if specified; otherwise, the name of the JWS file, without its extension, followed by Service.

For example, assume that you specified the following <WLHttpTransport> child element in the jwsc task that you use to build your web service:

```xml
<target name="build-service">
  <jwsc
    srcdir="src"
    destdir="${ear-dir}"
    keepGenerated='true'>
    <jws file="examples/webservices/complex/ComplexImpl.java"
      type="JAXWS">
      <WLHttpTransport
```

---

**Developing JAX-WS Web Services for Oracle WebLogic Server**
3.11 Configuring the Server Address Specified in the Dynamic WSDL

The WSDL of a deployed web service (also called dynamic WSDL) includes an
<address> element that assigns an address (URI) to a particular web service port. For
example, assume that the following WSDL snippet partially describes a deployed
WebLogic web service called ComplexService:

```xml
<definitions name="ComplexServiceDefinitions"
            targetNamespace="http://example.org">
  ...
  <service name="ComplexService">
    <port binding="s0:ComplexServiceSoapBinding" name="ComplexServicePort">
      <s1:address location="http://myhost:7101/complex/ComplexService"/>
    </port>
  </service>
</definitions>
```

The preceding example shows that the ComplexService web service includes a port
called ComplexServicePort, and this port has an address of

WebLogic Server determines the complex/ComplexService section of this address by
examining the contextPath and serviceUri attributes of the jwsc elements, as
described in Section 3.10, "Browsing to the WSDL of the Web Service." However, the
method WebLogic Server uses to determine the protocol and host section of the
address (http://myhost:7101, in the example) is more complicated, as described
below. For clarity, this section uses the term server address to refer to the protocol and
host section of the address.

The server address that WebLogic Server publishes in a dynamic WSDL of a deployed
web service depends on whether the web service can be invoked using HTTP/S or
JMS, whether you have configured a proxy server, whether the web service is
deployed to a cluster, or whether the web service is actually a callback service.

The following sections reflect these different configuration options, and provide links
to procedural information about changing the configuration to suit your needs.

- Section 3.11.1, "Web service is not a callback service and can be invoked using
  HTTP/S"
- Section 3.11.2, "Web service is a callback service"
- Section 3.11.3, "Web service is invoked using a proxy server"

It is assumed in the sections that you use the WebLogic Server Administration Console
to configure cluster and standalone servers.
### 3.11.1 Web service is not a callback service and can be invoked using HTTP/S

- If the web service is deployed to a cluster, the following values are used in the server address of the dynamic WSDL, in order of precedence:
  - Configured network channel, as described in Section 23.4.7, "Configuring the Identity of the Front-end SOAP Router Using Network Channels."
  - Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the cluster, as described in "Configure HTTP Settings for a Cluster" in Oracle WebLogic Server Administration Console Online Help.
  - Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the local server, as described in "Configure HTTP Protocol" in Oracle WebLogic Server Administration Console Online Help.
  - If none of the above items are set, the Cluster Address must be set for the cluster, as described in "Configure Clusters" in Oracle WebLogic Server Administration Console Online Help. The server channel for the specified protocol from the request URL (for example, http) will be used to generate the cluster address that is displayed in the WSDL.

- If the web service is deployed to an individual server, the Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the local server are used in the server address of the dynamic WSDL, as described in "Configure HTTP Protocol" in Oracle WebLogic Server Administration Console Online Help.

### 3.11.2 Web service is a callback service

1. If the callback service is deployed to a cluster, the following values are used in the server address of the dynamic WSDL, in order of precedence:
   - Configured network channel, as described in Section 23.4.7, "Configuring the Identity of the Front-end SOAP Router Using Network Channels."
   - Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the cluster, as described in "Configure HTTP Settings for a Cluster" in Oracle WebLogic Server Administration Console Online Help.
   - Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the local server, as described in "Configure HTTP Protocol" in Oracle WebLogic Server Administration Console Online Help.
   - Cluster Address for the cluster, as described in "Configure Clusters" in Oracle WebLogic Server Administration Console Online Help. The Cluster Address is required if no other values are set.

2. If the callback service is deployed to an individual server, the Frontend Host, Frontend HTTP Port, and Frontend HTTPS Port configured for the local server are used in the server address of the dynamic WSDL, as described in "Configure HTTP Protocol" in Oracle WebLogic Server Administration Console Online Help.

3. If none of the preceding values are set, but the Listen Address of the server to which the callback service is deployed is set, then WebLogic Server uses this value in the server address.

See "Configure Listen Addresses" in Oracle WebLogic Server Administration Console Online Help.
3.11.3 Web service is invoked using a proxy server

Although not required, Oracle recommends that you explicitly set the Frontend Host, FrontEnd HTTP Port, and Frontend HTTPS Port of either the cluster or individual server to which the web service is deployed to point to the proxy server.

See “Configure HTTP Settings for a Cluster” or “Configure HTTP Protocol” in Oracle WebLogic Server Administration Console Online Help.

3.12 Testing the Web Service

After you have deployed a WebLogic web service, you can test basic and advanced features of your web service, such as security, quality of service (QoS), HTTP headers, and so on. You can also perform stress testing of the security features. For information about testing web services using the Web Services Test Client or Fusion Middleware Control Test Web Service page, see “Testing Web Services” in Administering Web Services.

3.13 Integrating Web Services Into the WebLogic Split Development Directory Environment

This section describes how to integrate web services development into the WebLogic split development directory environment. It is assumed that you understand this WebLogic feature and have set up this type of environment for developing standard Java Platform, Enterprise Edition (Java EE) Version 5 applications and modules, such as EJBs and Web applications, and you want to update the single build.xml file to include web services development.

For detailed information about the WebLogic split development directory environment, see "Creating a Split Development Directory Environment” in Developing Applications for Oracle WebLogic Server and the splitdir/helloWorldEar example installed with WebLogic Server, located in the ORACLE_HOME/wlsServer/samples/server/examples/src/examples directory, where ORACLE_HOME represents the directory in which you installed WebLogic Server. For more information about the WebLogic Server code examples, see "Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.

1. In the main project directory, create a directory that will contain the JWS file that implements your web service.

   For example, if your main project directory is called /src/helloWorldEar, then create a directory called /src/helloWorldEar/helloWebService:

   prompt> mkdir /src/helloWorldEar/helloWebService

2. Create a directory hierarchy under the helloWebService directory that corresponds to the package name of your JWS file.

   For example, if your JWS file is in the package examples.splitdir.hello package, then create a directory hierarchy examples/splitdir/hello:

   prompt> cd /src/helloWorldEar/helloWebService
   prompt> mkdir examples/splitdir/hello

3. Put your JWS file in the just-created web service subdirectory of your main project directory (/src/helloWorldEar/helloWebService/examples/splitdir/hello in this example.)
4. In the build.xml file that builds the Enterprise application, create a new target to build the web service, adding a call to the jwsc WebLogic web service Ant task, as described in Section 3.6, "Running the jwsc WebLogic Web Services Ant Task."

The jwsc srcdir attribute should point to the top-level directory that contains the JWS file (helloWebService in this example). The jwsc destdir attribute should point to the same destination directory you specify for wlcompile, as shown in the following example:

```xml
<target name="build.helloWebService">
  <jwsc
    srcdir="helloWebService"
    destdir="destination_dir"
    keepGenerated="yes"
    >
    <jws file="examples/splitdir/hello/HelloWorldImpl.java"
         type="JAXWS" />
  </jwsc>
</target>
```

In the example, destination_dir refers to the destination directory that the other split development directory environment Ant tasks, such as wlappc and wlcompile, also use.

5. Update the main build target of the build.xml file to call the web service-related targets:

```xml
<!-- Builds the entire helloWorldEar application -->
<target name="build"
  description="Compiles helloWorldEar application and runs appc"
  depends="build-helloWebService,compile,appc" />
```

**Note:** When you actually build your Enterprise Application, be sure you run the jwsc Ant task before you run the wlappc Ant task. This is because wlappc requires some of the artifacts generated by jwsc for it to execute successfully. In the example, this means that you should specify the build-helloWebService target before the appc target.

6. If you use the wlcompile and wlappc Ant tasks to compile and validate the entire Enterprise Application, be sure to exclude the web service source directory for both Ant tasks. This is because the jwsc Ant task already took care of compiling and packaging the web service. For example:

```xml
<target name="compile">
  <wlcompile srcdir="${src.dir}" destdir="${dest.dir}"
    excludes="appStartup,helloWebService">
    ...
  </wlcompile>
  ...
</target>
```

```xml
<target name="appc">
  <wlappc source="${dest.dir}" deprecation="yes" debug="false"
    excludes="helloWebService"/>
</target>
```

7. Update the application.xml file in the META-INF project source directory, adding a <web> module and specifying the name of the WAR file generated by the jwsc Ant task.
For example, add the following to the `application.xml` file for the helloWorld web service:

```
<application>
...
<module>
  <web>
    <web-uri>examples/splitdir/hello/HelloWorldImpl.war</web-uri>
    <context-root>/hello</context-root>
  </web>
</module>
...
</application>
```

**Note:** The `jwsc` Ant task always generates a Web Application WAR file from the JWS file that implements your web service, unless you JWS file defines an EJB via the `@Stateless` annotation. In that case you must add an `<ejb>` module element to the `application.xml` file instead.

Your split development directory environment is now updated to include web service development. When you rebuild and deploy the entire Enterprise Application, the web service will also be deployed as part of the EAR. You invoke the web service in the standard way described in Section 3.10, "Browsing to the WSDL of the Web Service."
This chapter describes how to program the JWS file that implements your WebLogic web service using Java API for XML-based web services (JAX-WS).

This chapter includes the following sections:

- Section 4.1, "Overview of JWS Files and JWS Annotations"
- Section 4.2, "Java Requirements for a JWS File"
- Section 4.3, "Programming the JWS File: Typical Steps"
- Section 4.4, "Accessing Runtime Information About a Web Service"
- Section 4.5, "Should You Implement a Stateless or Singleton Session EJB?"
- Section 4.6, "Programming the User-Defined Java Data Type"
- Section 4.7, "Invoking Another Web Service from the JWS File"
- Section 4.8, "Using SOAP 1.2"
- Section 4.9, "Validating the XML Schema"
- Section 4.10, "JWS Programming Best Practices"

### 4.1 Overview of JWS Files and JWS Annotations

There are two ways to program a WebLogic web service from scratch:

1. Annotate a standard EJB or Java class with web service Java annotations, as defined by JSR-181, the JAX-WS specification, and by the WebLogic web services programming model.

2. Combine a standard EJB or Java class with the various XML descriptor files and artifacts specified by JSR-109 (such as, deployment descriptors, WSDL files, data mapping descriptors, data binding artifacts for user-defined data types, and so on).

Oracle strongly recommends using option 1 above. Instead of authoring XML metadata descriptors yourself, the WebLogic Ant tasks and runtime will generate the required descriptors and artifacts based on the annotations you include in your JWS. Not only is this process much easier, but it keeps the information about your web service in a central location, the JWS file, rather than scattering it across many Java and XML files.

The Java web service (JWS) annotated file is the core of your web service. It contains the Java code that determines how your web service behaves. A JWS file is an ordinary Java class file that uses Java metadata annotations to specify the shape and characteristics of the web service. The JWS annotations you can use in a JWS file...
include the standard ones defined by the web services Metadata for the Java Platform specification (JSR-181), described at http://www.jcp.org/en/jsr/detail?id=181, plus a set of additional annotations based on the type of web service you are building—JAX-WS or JAX-RPC. For a complete list of JWS annotations that are supported for JAX-WS and JAX-RPC web services, see "Web Service Annotation Support" in WebLogic Web Services Reference for Oracle WebLogic Server.

When programming the JWS file, you include annotations to program basic web service features. The annotations are used at different levels, or targets, in your JWS file. Some are used at the class-level to indicate that the annotation applies to the entire JWS file. Others are used at the method-level and yet others at the parameter level.

### 4.2 Java Requirements for a JWS File

When you program your JWS file, you must follow a set of requirements, as specified by the Web Services Metadata for the Java Platform specification (JSR-181) at http://www.jcp.org/en/jsr/detail?id=181. In particular, the Java class that implements the web service:

- Must be an outer public class, must not be declared final, and must not be abstract.
- Must have a default public constructor.
- Must not define a finalize() method.
- Must include, at a minimum, a @WebService JWS annotation at the class level to indicate that the JWS file implements a web service.
- May reference a service endpoint interface by using the @WebService.endpointInterface annotation. In this case, it is assumed that the service endpoint interface exists and you cannot specify any other JWS annotations in the JWS file other than @WebService.endpointInterface, @WebService.serviceName, and @WebService.targetNamespace.
- If JWS file does not implement a service endpoint interface, all public methods other than those inherited from java.lang.Object will be exposed as web service operations. This behavior can be overridden by using the @WebMethod annotation to specify explicitly the public methods that are to be exposed. If a @WebMethod annotation is present, only the methods to which it is applied are exposed.

### 4.3 Programming the JWS File: Typical Steps

The following procedure describes the typical steps for programming a JWS file that implements a web service.

---

**Note:** It is assumed that you have created a JWS file and now want to add JWS annotations to it.

---

For more information about each of the JWS annotations, see "JWS Annotation Reference" in WebLogic Web Services Reference for Oracle WebLogic Server.
### Table 4–1  Steps to Program the JWS File

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Import the standard JWS annotations that will be used in your JWS file.</td>
<td>The standard JWS annotations are in either the <code>javax.jws</code>, <code>javax.jws.soap</code>, or <code>javax.xml.ws</code> package. For example: import <code>javax.jws.WebMethod</code>; import <code>javax.jws.WebService</code>; import <code>javax.jws.soap.SOAPBinding</code>; import <code>javax.xml.ws.BindingType</code>;</td>
</tr>
<tr>
<td>2</td>
<td>Import additional annotations, as required.</td>
<td>For a complete list of JWS annotations that are supported, see &quot;Web Service Annotation Support&quot; in <a href="https://docs.oracle.com/cd/E25288_01/wls.111112/e25296/">WebLogic Web Services Reference for Oracle WebLogic Server</a>.</td>
</tr>
<tr>
<td>3</td>
<td>Add the standard required <code>@WebService</code> JWS annotation at the class level to specify that the Java class exposes a web service.</td>
<td>See Section 4.3.2, &quot;Specifying that the JWS File Implements a Web Service (<code>@WebService</code> Annotation).&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Add the standard <code>@SOAPBinding</code> JWS annotation at the class level to specify the mapping between the web service and the SOAP message protocol. (Optional)</td>
<td>In particular, use this annotation to specify whether the web service is document-literal, document-encoded, and so on. See Section 4.3.3, &quot;Specifying the Mapping of the Web Service to the SOAP Message Protocol (<code>@SOAPBinding</code> Annotation).&quot; Although this JWS annotation is not required, Oracle recommends you explicitly specify it in your JWS file to clarify the type of SOAP bindings a client application uses to invoke the web service.</td>
</tr>
<tr>
<td>5</td>
<td>Add the JAX-WS <code>@BindingType</code> JWS annotation at the class level to specify the binding type to use for a web service endpoint implementation class. (Optional)</td>
<td>See Section 4.3.7, &quot;Specifying the Binding to Use for an Endpoint (<code>@BindingType</code> Annotation).&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Add the standard <code>@WebMethod</code> annotation for each method in the JWS file that you want to expose as a public operation. (Optional)</td>
<td>Optionally specify that the operation takes only input parameters but does not return any value by using the standard <code>@Oneway</code> annotation. See Section 4.3.4, &quot;Specifying That a JWS Method Be Exposed as a Public Operation (<code>@WebMethod</code> and <code>@OneWay</code> Annotations).&quot;</td>
</tr>
<tr>
<td>7</td>
<td>Add <code>@WebParam</code> annotation to customize the name of the input parameters of the exposed operations. (Optional)</td>
<td>See Section 4.3.5, &quot;Customizing the Mapping Between Operation Parameters and WSDL Elements (<code>@WebParam</code> Annotation).&quot;</td>
</tr>
<tr>
<td>8</td>
<td>Add <code>@WebResult</code> annotations to customize the name and behavior of the return value of the exposed operations. (Optional)</td>
<td>See Section 4.3.6, &quot;Customizing the Mapping Between the Operation Return Value and a WSDL Element (<code>@WebResult</code> Annotation).&quot;</td>
</tr>
<tr>
<td>9</td>
<td>Add your business code.</td>
<td>Add your business code to the methods to make the WebService behave as required.</td>
</tr>
</tbody>
</table>

### 4.3.1 Example of a JWS File

The following sample JWS file shows how to implement a simple web service.

```java
package examples.webservices.simple;

// Import the standard JWS annotation interfaces
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
```

---

**Programming the JWS File** 4-3
public class SimpleImpl {

    // Standard JWS annotation that specifies that the method should be exposed
    // as a public operation. Because the annotation does not include the
    // member-value "operationName", the public name of the operation is the
    // same as the method name: sayHello.
    @WebMethod()
    public String sayHello(String message) {
        System.out.println("sayHello:" + message);
        return "Here is the message: '" + message + "'");
    }
}

4.3.2 Specifying that the JWS File Implements a Web Service (@WebService Annotation)

Use the standard @WebService annotation to specify, at the class level, that the JWS file
implements a web service, as shown in the following code excerpt:

@WebService(name="SimplePortType", serviceName="SimpleService",
            targetNamespace="http://example.org")

In the example, the name of the web service is SimplePortType, which will later map
to the wsdl:portType element in the WSDL file generated by the jwsc Ant task. The
service name is SimpleService, which will map to the wsdl:service element in the
generated WSDL file. The target namespace used in the generated WSDL is
http://example.org.

You can also specify the following additional attributes of the @WebService annotation:

- endpointInterface—Fully qualified name of an existing service endpoint
  interface file. This annotation allows the separation of interface definition from the
  implementation. If you specify this attribute, the jwsc Ant task does not generate
  the interface for you, but assumes you have created it and it is in your
  CLASSPATH.
- portname—Name that is used in the wsdl:port.

None of the attributes of the @WebService annotation is required. See the Web Services
for the default values of each attribute.
4.3.3 Specifying the Mapping of the Web Service to the SOAP Message Protocol (@SOAPBinding Annotation)

It is assumed that you want your web service to be available over the SOAP message protocol; for this reason, your JWS file should include the standard @SOAPBinding annotation, at the class level, to specify the SOAP bindings of the web service (such as, document-encoded or document-literal-wrapped), as shown in the following code excerpt:

```java
@SOAPBinding(style=SOAPBinding.Style.DOCUMENT,
             use=SOAPBinding.Use.LITERAL,
             parameterStyle=SOAPBinding.ParameterStyle.WRAPPED)
```

In the example, the web service uses document-wrapped-style encodings and literal message formats, which are also the default formats if you do not specify the @SOAPBinding annotation. In general, document-literal-wrapped web services are the most interoperable type of web service.

You use the parameterStyle attribute (in conjunction with the style attribute) to specify whether the web service operation parameters represent the entire SOAP message body, or whether the parameters are elements wrapped inside a top-level element with the same name as the operation.

The following table lists the possible and default values for the three attributes of the @SOAPBinding (either the standard or WebLogic-specific) annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Possible Values</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>style</td>
<td>SOAPBinding.Style.RPC</td>
<td>SOAPBinding.Style.DOCUMENT</td>
</tr>
<tr>
<td></td>
<td>SOAPBinding.Style.DOCUMENT</td>
<td></td>
</tr>
<tr>
<td>use</td>
<td>SOAPBinding.Use.LITERAL</td>
<td>SOAPBinding.Use.LITERAL</td>
</tr>
<tr>
<td>parameterStyle</td>
<td>SOAPBinding.ParameterStyle.BARE</td>
<td>SOAPBinding.ParameterStyle.WRAPPED</td>
</tr>
<tr>
<td></td>
<td>SOAPBinding.ParameterStyle.WRAPPED</td>
<td></td>
</tr>
</tbody>
</table>

4.3.4 Specifying That a JWS Method Be Exposed as a Public Operation (@WebMethod and @OneWay Annotations)

Use the standard @WebMethod annotation to specify that a method of the JWS file should be exposed as a public operation of the web service, as shown in the following code excerpt:

```java
public class SimpleImpl {
    @WebMethod(operationName="sayHelloOperation")
    public String sayHello(String message) {
        System.out.println("sayHello:" + message);
        return "Here is the message: \\
        " + message + \\
        ";"
    }
    ...
}
```

In the example, the sayHello() method of the SimpleImpl JWS file is exposed as a public operation of the web service. The operationName attribute specifies, however, that the public name of the operation in the WSDL file is sayHelloOperation. If you do not specify the operationName attribute, the public name of the operation is the name of the method itself.
You can also use the `action` attribute to specify the action of the operation. When using SOAP as a binding, the value of the `action` attribute determines the value of the `SOAPAction` header in the SOAP messages.

To exclude a method as a web service operation, specify `@WebMethod(exclude="true")`.

---

**Note:** For JAX-WS, the service endpoint interface (SEI) defines the public methods. If no SEI exists, then all public methods are exposed as web service operations, unless they are tagged explicitly with `@WebMethod(exclude="true")`.

---

You can specify that an operation not return a value to the calling application by using the standard `@Oneway` annotation, as shown in the following example:

```java
public class OneWayImpl {
    @WebMethod()
    @Oneway()
    public void ping() {
        System.out.println("ping operation");
    }
    ...
}
```

If you specify that an operation is one-way, the implementing method is required to return `void`, cannot use a Holder class as a parameter, and cannot throw any checked exceptions.

None of the attributes of the `@WebMethod` annotation is required. See the Web Services Metadata for the Java Platform (JSR 181) at [http://www.jcp.org/en/jsr/detail?id=181](http://www.jcp.org/en/jsr/detail?id=181) for the default values of each attribute, as well as additional information about the `@WebMethod` and `@Oneway` annotations.

### 4.3.5 Customizing the Mapping Between Operation Parameters and WSDL Elements (`@WebParam` Annotation)

Use the standard `@WebParam` annotation to customize the mapping between operation input parameters of the web service and elements of the generated WSDL file, as well as specify the behavior of the parameter, as shown in the following code excerpt:

```java
public class SimpleImpl {
    @WebMethod()
    @WebResult(name="IntegerOutput",
               targetNamespace="http://example.org/docLiteralBare")
    public int echoInt(
            @WebParam(name="IntegerInput",
                      targetNamespace="http://example.org/docLiteralBare")
            int input)
    {
        System.out.println("echoInt "+ input + " to you too!");
        return input;
    }
    ...
}
```

In the example, the name of the parameter of the `echoInt` operation in the generated WSDL is `IntegerInput`; if the `@WebParam` annotation were not present in the JWS file, the name of the parameter in the generated WSDL file would be the same as the name of the method's parameter `input`. The `targetNamespace` attribute specifies that the XML namespace for the parameter is `http://example.org/docLiteralBare`; this
attribute is relevant only when using document-style SOAP bindings where the parameter maps to an XML element.

You can also specify the following additional attributes of the @WebParam annotation:

- **mode**—The direction in which the parameter is flowing (WebParam.Mode.IN, WebParam.Mode.OUT, or WebParam.Mode.INOUT). OUT and INOUT modes are only supported for RPC-style operations or for parameters that map to headers.

- **header**—Boolean attribute that, when set to true, specifies that the value of the parameter should be retrieved from the SOAP header, rather than the default body.

None of the attributes of the @WebParam annotation is required. See the Web Services Metadata for the Java Platform (JSR 181) at http://www.jcp.org/en/jsr/detail?id=181 for the default value of each attribute.

### 4.3.6 Customizing the Mapping Between the Operation Return Value and a WSDL Element (@WebResult Annotation)

Use the standard @WebResult annotation to customize the mapping between the web service operation return value and the corresponding element of the generated WSDL file, as shown in the following code excerpt:

```java
public class Simple {
    @WebMethod()
    @WebResult(name="IntegerOutput",
               targetNamespace="http://example.org/docLiteralBare")
    public int echoInt(
            @WebParam(name="IntegerInput",
                      targetNamespace="http://example.org/docLiteralBare")
            int input)
    {
        System.out.println("echoInt " + input + " to you too!");
        return input;
    }
    ...
}
```

In the example, the name of the return value of the echoInt operation in the generated WSDL is IntegerOutput; if the @WebResult annotation were not present in the JWS file, the name of the return value in the generated WSDL file would be the hard-coded name return. The targetNamespace attribute specifies that the XML namespace for the return value is http://example.org/docLiteralBare; this attribute is relevant only when using document-style SOAP bindings where the return value maps to an XML element.

None of the attributes of the @WebResult annotation is required. See the Web Services Metadata for the Java Platform (JSR 181) at http://www.jcp.org/en/jsr/detail?id=181 for the default value of each attribute.

### 4.3.7 Specifying the Binding to Use for an Endpoint (@BindingType Annotation)

Use the JAX-WS javax.xml.ws.BindingType annotation to customize the binding to use for a web service endpoint implementation class, as shown in the following code excerpt:

```java
import javax.xml.ws.BindingType;
import javax.xml.ws.soap.SOAPBinding;
public class Simple {
    @WebService()
```
In the example, the deployed endpoint would use the SOAP 1.2 over HTTP binding. If not specified, the binding defaults to SOAP 1.1 over HTTP.

Table 4–3 lists the bindings that are supported for JAX-WS web services.

### Table 4–3 Bindings Supported for JAX-WS Web Services

<table>
<thead>
<tr>
<th>Binding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>javax.xml.ws.soap.SOAPBinding.SOAP12HTTP_BINDING</td>
<td>SOAP 1.2 over HTTP binding.</td>
</tr>
<tr>
<td>javax.xml.ws.soap.SOAPBinding.SOAP11HTTP_BINDING</td>
<td>SOAP 1.1 over HTTP binding. This is the default for SOAP over HTTP transport connection protocol.</td>
</tr>
<tr>
<td>javax.xml.ws.soap.SOAPBinding.SOAP12HTTP_MTOM_BINDING</td>
<td>SOAP 1.2 over HTTP and Message Transmission Optimized Mechanism (MTOM) binding.</td>
</tr>
<tr>
<td>javax.xml.ws.soap.SOAPBinding.SOAP11HTTP_MTOM_BINDING</td>
<td>SOAP 1.1 over HTTP and Message Transmission Optimized Mechanism (MTOM) binding.</td>
</tr>
</tbody>
</table>

You can also specify the following additional attributes of the @BindingType annotation:

- `features`—An array of features to enable/disable on the specified binding. If not specified, features are enabled based on their own rules.

For more information about the @BindingType annotation, see JAX-WS 2.1 Annotations at [http://jax-ws.java.net/nonav/2.1.4/docs/annotations.html](http://jax-ws.java.net/nonav/2.1.4/docs/annotations.html).

## 4.4 Accessing Runtime Information About a Web Service

When a client application invokes a WebLogic web service that was implemented with a JWS file, WebLogic Server automatically creates a context that the web service or client can use to access, and sometimes change, runtime information about the service.

To access runtime information, you can use one of the following methods:

- `javax.xml.ws.BindingProvider` ([http://docs.oracle.com/javaee/7/api/javax/xml/ws/BindingProvider.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/BindingProvider.html))—From the client application, access the request and response context of the protocol binding. See Section 4.4.1, "Accessing the Protocol Binding Context."

- `javax.xml.ws.WebServiceContext` ([http://docs.oracle.com/javaee/7/api/javax/xml/ws/WebServiceContext.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/WebServiceContext.html))—From the web service, access runtime message context and security information relative to a request being served. Typically, a WebServiceContext is injected into an endpoint using the @Resource annotation. See Section 4.4.2, "Accessing the Web Service Context."
Accessing Runtime Information About a Web Service

■

javax.xml.ws.handler.MessageContext
(http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContex
t.html)—Access a set of runtime properties from a message handler—from the
client application or web service—or directly from the WebServiceContext from a
web service. See Section 4.4.3, "Using the MessageContext Property Values."

The following sections describe how to use the BindingProvider, WebServiceContext,
and MessageContext to access runtime information in more detail.

4.4.1 Accessing the Protocol Binding Context
The com.sun.xml.ws.developer.JAXWSProperties and
com.sun.xml.ws.client.BindingProviderProperties APIs are
supported as an extension to the JDK 6.0. Because the APIs are not
provided as part of the JDK 6.0 kit, they are subject to change.
Note:

The javax.xml.ws.BindingProvider interface enables you to access from the client
application the request and response context of the protocol binding. For more
information, see
http://docs.oracle.com/javaee/7/api/javax/xml/ws/BindingProvider.html. For
more information about developing web service client files, see "Developing Web
Service Clients" on page 8-1.
The following example shows a simple web service client application that uses the
context to access HTTP request header information. The code in bold is discussed in
the programming guidelines described following the example.
package examples.webservices.hello_world.client;
import
import
import
import
import
import
import
import

javax.xml.namespace.QName;
java.net.MalformedURLException;
java.net.URL;
java.util.Map;
javax.xml.ws.BindingProvider;
javax.xml.ws.handler.MessageContext;
com.sun.xml.ws.developer.JAXWSProperties;
com.sun.xml.ws.client.BindingProviderProperties;

/**
* This is a simple standalone client application that invokes the
* the <code>sayHelloWorld</code> operation of the Simple web service.
*/
public class Main {
public static void main(String[] args) {
HelloWorldService service;
try {
service = new HelloWorldService(new URL(args[0] + "?WSDL"),
new QName("http://hello_world.webservices.examples/",
"HelloWorldService") );
} catch (MalformedURLException murl) { throw new RuntimeException(murl); }
HelloWorldPortType port = service.getHelloWorldPortTypePort();
Map requestContext = ((BindingProvider)port).getRequestContext();
requestContext.put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
"http://examples.com/HelloWorldImpl/HelloWorldService");
requestContext.put(JAXWSProperties.CONNECT_TIMEOUT, 300);
requestContext.put(BindingProviderProperties.REQUEST_TIMEOUT, 300);

Programming the JWS File 4-9


String result = null;
result = port.sayHelloWorld("Hi there!");
System.out.println( 'Got result: ' + result );
Map responseContext = ((BindingProvider)port).getResponseContext();
Integer responseCode =
      (Integer)responseContext.get(MessageContext.HTTP_RESPONSE_CODE);
...
}

Use the following guidelines in your JWS file to access the runtime context of the web service, as shown in the code in bold in the preceding example:

- Import the javax.xml.ws.BindingProvider API, as well as any other related APIs that you might use:
  import java.util.Map;
  import javax.xml.ws.BindingProvider;
  import javax.xml.ws.handler.MessageContext;
  import com.sun.xml.ws.developer.JAXWSProperties;
  import com.sun.xml.ws.client.BindingProviderProperties;

- Use the methods of the BindingProvider class to access the binding protocol context information. The following example shows how to get the request and response context for the protocol binding and subsequently set the target service endpoint address used by the client for the request context, set the connection and read timeouts (in milliseconds) for the request context, and set the HTTP response status code for the response context:

```java
Map requestContext = ((BindingProvider)port).getRequestContext();
requestContext.put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY, "http://examples.com/HelloWorldImpl/HelloWorldService");
requestContext.put(JAXWSProperties.CONNECT_TIMEOUT, 300);
requestContext.put(BindingProviderProperties.REQUEST_TIMEOUT, 300);
...
Map responseContext = ((BindingProvider)port).getResponseContext();
Integer responseCode =
      (Integer)responseContext.get(MessageContext.HTTP_RESPONSE_CODE);
```

The following table summarizes the methods of the javax.xml.ws.BindingProvider that you can use in your JWS file to access runtime information about the web service.

<table>
<thead>
<tr>
<th>Method</th>
<th>Returns</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getBinding()</td>
<td>Binding</td>
<td>Returns the binding for the binding provider.</td>
</tr>
<tr>
<td>getRequestContext()</td>
<td>java.util.Map</td>
<td>Returns the context that is used to initialize the message and context for request messages.</td>
</tr>
<tr>
<td>getResponseContext()</td>
<td>java.util.Map</td>
<td>Returns the response context.</td>
</tr>
</tbody>
</table>

One you get the request or response context, you can access the BindingProvider property values defined in the following table and the MessageContext property values defined in Section 4.4.3, "Using the MessageContext Property Values."
In addition, in the previous example:

- The `JAXWSProperties.CONNECT_TIMEOUT` property is used to define the connection timeout. For a complete list of `JAXWSProperties` that you can set, see the [Javadoc](http://jax-ws.java.net/nonav/jax-ws-20-fcs/arch/com/sun/xml/ws/developer/JAXWSProperties.html#CONNECT_TIMEOUT).

- The `BindingProviderProperties.REQUEST_TIMEOUT` property is used to define the request timeout. For a complete list of `BindingProviderProperties` that you can set, see the [Javadoc](http://jax-ws.java.net/nonav/jax-ws-20-fcs/arch/com/sun/xml/ws/client/BindingProviderProperties.html#REQUEST_TIMEOUT).

### 4.4.2 Accessing the Web Service Context

The `javax.xml.ws.WebServiceContext` interface enables you to access from the web service runtime message context and security information relative to a request being served. Typically, a `WebServiceContext` is injected into an endpoint using the `@Resource` annotation. For more information, see [documentation](http://docs.oracle.com/javaee/7/api/javax/xml/ws/WebServiceContext.html).

The following example shows a simple JWS file that uses the context to access HTTP request header information. The code in **bold** is discussed in the programming guidelines described following the example.

```java
package examples.webservices.jws_context;
import javax.jws.WebMethod;
import javax.jws.WebService;
import java.util.Map;
import javax.xml.ws.WebServiceContext;
import javax.annotation.Resource;
import javax.xml.ws.handler.MessageContext;

@WebService(name="JwsContextPortType", serviceName="JwsContextService",
    targetNamespace="http://example.org")
/**
 * Simple web service to show how to use the @Context annotation.
 */
public class JwsContextImpl {
    @Resource
    private WebServiceContext ctx;
```
Use the following guidelines in your JWS file to access the runtime context of the web service, as shown in the code in **bold** in the preceding example:

- Import the `@javax.annotation.Resource` JWS annotation:
  ```java
  import javax.annotation.Resource;
  ```
- Import the `javax.xml.ws.WebServiceContext` API, as well as any other related APIs that you might use:
  ```java
  import java.util.Map;
  import javax.xml.ws.WebServiceContext;
  import javax.xml.ws.handler.MessageContext;
  ```
- Annotate a private variable, of data type `javax.xml.ws.WebServiceContext`, with the field-level `@Resource` JWS annotation:
  ```java
  @Resource
  private WebServiceContext ctx;
  ```
- Use the methods of the `WebServiceContext` class to access runtime information about the web service. The following example shows how to get the message context for the current service request and subsequently access the HTTP request headers:
  ```java
  MessageContext context=ctx.getMessageContext();
  Map requestHeaders = (Map)context.get(MessageContext.HTTP_REQUEST_HEADERS);
  ```

For more information about the `MessageContext` property values, see Section 4.4.3, "Using the `MessageContext` Property Values."

The following table summarizes the methods of the `javax.xml.ws.WebServiceContext` that you can use in your JWS file to access runtime information about the web service. For more information, see [http://docs.oracle.com/javaee/7/api/javax/xml/ws/WebServiceContext.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/WebServiceContext.html).

<table>
<thead>
<tr>
<th>Method</th>
<th>Returns</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getMessageContext()</td>
<td>MessageContext</td>
<td>Returns the <code>MessageContext</code> for the current service request. You can access properties that are application-scoped only, such as <code>HTTP_REQUEST_HEADERS</code>, <code>MESSAGE_ATTACHMENTS</code>, and so on, as defined in Section 4.4.3, &quot;Using the <code>MessageContext</code> Property Values.&quot;</td>
</tr>
<tr>
<td>getUserPrincipal()</td>
<td>java.security.Principal</td>
<td>Returns the <code>Principal</code> that identifies the sender of the current service request. If the sender has not been authenticated, the method returns <code>null</code>.</td>
</tr>
<tr>
<td>isUserInRole(java.lang.String role)</td>
<td>boolean</td>
<td>Returns a boolean value specifying whether the authenticated user is included in the specified logical role. If the user has not been authenticated, the method returns <code>false</code>.</td>
</tr>
</tbody>
</table>
### 4.4.3 Using the MessageContext Property Values

The following table defined the `javax.xml.ws.handler.MessageContext` property values that you can access from a message handler—from the client application or web service—or directly from the `WebServiceContext` from the web service. For more information, see the `javax.xml.ws.handler.MessageContext` Javadocs at [http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContext.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContext.html).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP_REQUEST_HEADERS</td>
<td><code>java.util.Map</code></td>
<td>Map of HTTP request headers for the request message.</td>
</tr>
<tr>
<td>HTTP_REQUEST_METHOD</td>
<td><code>java.lang.String</code></td>
<td>HTTP request method for example GET, POST, or PUT.</td>
</tr>
<tr>
<td>HTTP_RESPONSE_CODE</td>
<td><code>java.lang.Integer</code></td>
<td>HTTP response status code for the last invocation.</td>
</tr>
<tr>
<td>HTTP_RESPONSE_HEADERS</td>
<td><code>java.util.Map</code></td>
<td>HTTP response headers.</td>
</tr>
<tr>
<td>INBOUND_MESSAGE_ATTACHMENTS</td>
<td><code>java.util.Map</code></td>
<td>Map of attachments for the inbound messages.</td>
</tr>
<tr>
<td>MESSAGE_OUTBOUND_PROPERTY</td>
<td><code>java.lang.Boolean</code></td>
<td>Message direction. This property is <code>true</code> for outbound messages and <code>false</code> for inbound messages.</td>
</tr>
<tr>
<td>OUTBOUND_MESSAGE_ATTACHMENTS</td>
<td><code>java.util.Map</code></td>
<td>Map of attachments for the outbound messages.</td>
</tr>
<tr>
<td>PATH_INFO</td>
<td><code>java.lang.String</code></td>
<td>Request path information.</td>
</tr>
<tr>
<td>QUERY_STRING</td>
<td><code>java.lang.String</code></td>
<td>Query string for request.</td>
</tr>
<tr>
<td>REFERENCE_PARAMETERS</td>
<td><code>java.awt.List</code></td>
<td>WS-Addressing reference parameters. The list must include all SOAP headers marked with the <code>wsa:IsReferenceParameter=&quot;true&quot;</code> attribute.</td>
</tr>
<tr>
<td>SERVLET_CONTEXT</td>
<td><code>javax.servlet.ServletContext</code></td>
<td>Servlet context object associated with request.</td>
</tr>
<tr>
<td>WSDL_DESCRIPTION</td>
<td><code>org.xml.sax.InputSource</code></td>
<td>Input source (resolvable URI) for the WSDL document.</td>
</tr>
<tr>
<td>WSDL_INTERFACE</td>
<td><code>javax.xml.namespace.QName</code></td>
<td>Name of the WSDL interface or port type.</td>
</tr>
<tr>
<td>WSDL_OPERATION</td>
<td><code>javax.xml.namespace.QName</code></td>
<td>Name of the WSDL operation to which the current message belongs.</td>
</tr>
<tr>
<td>WSDL_PORT</td>
<td><code>javax.xml.namespace.QName</code></td>
<td>Name of the WSDL port to which the message was received.</td>
</tr>
<tr>
<td>WSDL_SERVICE</td>
<td><code>javax.xml.namespace.QName</code></td>
<td>Name of the service being invoked.</td>
</tr>
</tbody>
</table>

### 4.5 Should You Implement a Stateless or Singleton Session EJB?

The `jwsc` Ant task always chooses a plain Java object as the underlying implementation of a web service when processing your JWS file.

Sometimes, however, you may want the underlying implementation of your web service to be a stateless or singleton session EJB to take advantage of all that EJBs have
to offer, such as instance pooling, transactions, security, container-managed persistence, container-managed relationships, and data caching. If you decide you want an EJB implementation for your web service, then follow the programming guidelines in the following section.

EJB 3.0 introduced metadata annotations that enable you to automatically generate, rather than manually create, the EJB Remote and Home interface classes and deployment descriptor files needed when implementing an EJB. For more information about EJB 3.0, see Developing Enterprise JavaBeans for Oracle WebLogic Server.

By default, EJB-based web services are packaged as a JAR file. When building the EJB-based web service, you can specify that it be packaged as a WAR file by updating the jwsc Ant task in your build.xml file to enable the ejbWsInWar attribute in the module child element. For more information, see "jwsc" in WebLogic Web Services Reference for Oracle WebLogic Server.

To implement an EJB in your JWS file, perform the following steps:

- Import the EJB annotations, all of which are in the javax.ejb package. At a minimum you need to import the @Stateless or @Singleton annotation. You can also specify additional EJB annotations in your JWS file to specify the shape and behavior of the EJB. For more information, see the javax.ejb Javadoc at http://docs.oracle.com/javaee/7/api/javax/ejb/package-summary.html.

  For example:
  ```java
  import javax.ejb.Stateless;
  ```

- At a minimum, use the @Stateless or @Singleton annotation at the class level to identify the EJB:

  ```java
  @Stateless
  public class SimpleEjbImpl {
  ```

The following example shows a simple JWS file that implement a stateless session EJB. The relevant code is shown in bold.

```java
package examples.webservices.jaxws;

import weblogic.transaction.TransactionHelper;
import javax.ejb.Stateless;
import javax.ejb.SessionContext;
import javax.ejb.TransactionAttribute;
import javax.ejb.TransactionAttributeType;
import javax.annotation.Resource;
import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.transaction.SystemException;
import javax.transaction.Status;
import javax.transaction.Transaction;
import javax.xml.ws.WebServiceContext;

/**
 * A transaction-awared stateless EJB-implemented JWS
 */

// Standard JWS annotation that specifies that the portName,serviceName and
// target Namespace of the Web Service.
@WebService(
    name = "Simple",
    portName = "SimpleEJBPort",
    serviceName = "SimpleEjbService",
```
targetNamespace = "http://wls/samples")

// Standard EJB annotation
@Stateless
public class SimpleEjbImpl {

@Resource
private WebServiceContext context;
private String constructed = null;

// The WebMethod annotation exposes the subsequent method as a public
// operation on the Web Service.
@WebMethod()
@TransactionAttribute(TransactionAttributeType.REQUIRED)
public String sayHello(String s) throws SystemException {
    Transaction transaction =
        TransactionHelper.getTransactionHelper().getTransaction();
    int status = transaction.getStatus();
    if (Status.STATUS_ACTIVE != status)
        throw new IllegalStateException("transaction did not start,
            status is: " + status + ", check ejb annotation processing");
    return constructed + ":" + s;
}

4.6 Programming the User-Defined Java Data Type

The methods of the JWS file that are exposed as web service operations do not
necessarily take built-in data types (such as Strings and integers) as parameters and
return values, but rather, might use a Java data type that you create yourself. An
example of a user-defined data type is TradeResult, which has two fields: a String
stock symbol and an integer number of shares traded.

If your JWS file uses user-defined data types as parameters or return values of one or
more of its methods, you must create the Java code of the data type yourself, and then
import the class into your JWS file and use it appropriately. The jwsc Ant task will
later take care of creating all the necessary data binding artifacts.

Follow these basic requirements when writing the Java class for your user-defined
data type:

■ Define a default constructor, which is a constructor that takes no parameters.

■ Define both getXXX() and setXXX() methods for each member variable that you
  want to publicly expose.

■ Make the data type of each exposed member variable one of the built-in data
types, or another user-defined data type that consists of built-in data types.

---

**Note:** You can use JAXB to provide custom mapping. For more
information, see "Customizing Java-to-XML Schema Mapping Using
JAXB Annotations" on page 5-10.

---

The jwsc Ant task can generate data binding artifacts for most common XML and Java
data types. For the list of supported user-defined data types, see Section 5.3.2,
"Supported User-Defined Data Types." See Section 5.3.1, "Supported Built-In Data
Types” for the full list of supported built-in data types.
The following example shows a simple Java user-defined data type called BasicStruct:

```java
package examples.webservices.complex;

/**
 * Defines a simple JavaBean called BasicStruct that has integer, String,
 * and String[] properties
 */
public class BasicStruct {
    // Properties
    private int intValue;
    private String stringValue;
    private String[] stringArray;
    // Getter and setter methods
    public int getIntValue() {
        return intValue;
    }
    public void setIntValue(int intValue) {
        this.intValue = intValue;
    }
    public String getstringValue() {
        return stringValue;
    }
    public void setStringValue(String stringValue) {
        this.stringValue = stringValue;
    }
    public String[] getStringArray() {
        return stringArray;
    }
    public void setStringArray(String[] stringArray) {
        this.stringArray = stringArray;
    }
}
```

The following snippets from a JWS file show how to import the BasicStruct class and use it as both a parameter and return value for one of its methods; for the full JWS file, see Section 6.2.2, "Sample ComplexImpl.java JWS File":

```java
package examples.webservices.complex;

import javax.jws.WebMethod;
import javax.jws.WebParam;
import javax.jws.WebResult;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import examples.webservices.complex.BasicStruct;

@WebService(serviceName="ComplexService", name="ComplexPortType",
            targetNamespace="http://example.org")

public class ComplexImpl {
    @WebMethod(operationName="echoComplexType")
    public BasicStruct echoStruct(BasicStruct struct) {
        return struct;
    }
}
```

---

Flexible Web Services with Oracle WebLogic Server

Oracle WebLogic Server enables you to create rich, extensible, and flexible Web services. By using JAX-WS and the Oracle WebLogic Server Adapter, you can create custom Web services that leverage the capabilities of WebLogic Server. This section provides an overview of how to develop JAX-WS Web services for Oracle WebLogic Server, including practical examples and best practices.
4.7 Invoking Another Web Service from the JWS File

From within your JWS file you can invoke another web service, either one deployed on WebLogic Server or one deployed on some other application server, such as .NET. The steps to do this are similar to those described in Section 9.2, "Invoking a Web Service from a WebLogic Web Service," except that rather than running the cltientgen Ant task to generate the client stubs, you include a <clientgen> child element of the jwsc Ant task that builds the invoking web service to generate the client stubs instead. You then use the standard JAX-WS APIs in your JWS file, the same as you do for a Java SE client application.

See Section 8.4, "Invoking a Web Service from Another WebLogic Web Service" for detailed instructions.

4.8 Using SOAP 1.2

WebLogic web services use, by default, Version 1.1 of Simple Object Access Protocol (SOAP) as the message format when transmitting data and invocation calls between the web service and its client. WebLogic web services support both SOAP 1.1 and the newer SOAP 1.2, and you are free to use either version.

To specify that the web service use Version 1.2 of SOAP, use the class-level @javax.xml.ws.BindingType annotation in your JWS file and set its single attribute to the value SOAPBinding.SOAP12HTTP_BINDING, as shown in the following example (relevant code shown in bold):

```java
package examples.webservices.soap12;
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.xml.ws.BindingType;
import javax.xml.ws.SOAPBinding;
@WebService(name="SOAP12PortType",
            serviceName="SOAP12Service",
            targetNamespace="http://example.org")
@BindingType(value = SOAPBinding.SOAP12HTTP_BINDING)
/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic Web Service with a single operation: sayHello. The class uses SOAP 1.2 as its binding.
 *
 */
public class SOAP12Impl {
    @WebMethod()
    public String sayHello(String message) {
        System.out.println("sayHello:" + message);
        return "Here is the message: '' + message + "'");
    }
}
```

Other than set this annotation, you do not have to do anything else for the web service to use SOAP 1.2, including changing client applications that invoke the web service; the WebLogic web services runtime takes care of all the rest.

4.9 Validating the XML Schema

By default, SOAP messages are not validated against their XML schemas. You can enable XML schema validation for document-literal web services on the server or
Validating the XML Schema

client, as described in the following sections. In the event a SOAP message is invalid, a SOAP fault is returned.

**Note:** This feature adds a small amount of extra processing to a web service request.

By default, the stack trace is included in the details of the SOAP fault. To disable the stack trace, see Section 19.6, "Disabling the Stack Trace from the SOAP Fault."

### 4.9.1 Enabling Schema Validation on the Server

**Note:** The com.sun.xml.ws.developer.SchemaValidation API is supported as an extension to the JDK 6.0. Because this API is not provided as part of the JDK 6.0 kit, it is subject to change.

To enable schema validation on the server, add the @SchemaValidation annotation on the endpoint implementation. For example:

```java
import com.sun.xml.ws.developer.SchemaValidation;
import javax.jws.WebService;
@SchemaValidation
@WebService(name="HelloWorldPortType", serviceName="HelloWorldService")
public class HelloWorldImpl {
    public String sayHelloWorld(String message) {
        System.out.println("sayHelloWorld:" + message);
        return "Here is the message: "+ message + ";";
    }
}
```

You can pass your own validation error handler class as an argument to the annotation, if you want to manage errors within your application. For example:

```java
@SchemaValidation(handler=ErrorHandler.class)
```

### 4.9.2 Enabling Schema Validation on the Client

**Note:** The com.sun.xml.ws.developer.SchemaValidationFeature API is supported as an extension to the JDK 6.0. Because this API is not provided as part of the JDK 6.0 kit, it is subject to change.

To enable schema validation on the client, create a SchemaValidationFeature object and pass this as an argument when creating the PortType stub implementation.

```java
package examples.webservices.hello_world.client;
import com.sun.xml.ws.developer.SchemaValidationFeature;
import javax.xml.namespace.QName;
import java.net.MalformedURLException;
import java.net.URL;
public class Main {
    public static void main(String[] args) {
        HelloWorldService service;
        try {
            service = ...
        }
    }
}
```
service = new HelloWorldService(new URL(args[0] + "?WSDL"),
      new QName("http://example.org", "HelloWorldService") );
  } catch (MalformedURLException murl) { throw new RuntimeException(murl); }
  SchemaValidationFeature feature =
    new SchemaValidationFeature();
  HelloWorldPortType port = service.getHelloWorldPortTypePort(feature);
  String result = null;
  result = port.sayHelloWorld("Hi there!");
  System.out.println("Got result: * + result ");
}

You can pass your own validation error handler as an argument to the
SchemaValidationFeature object, if you want to manage errors within your
application. For example:

SchemaValidationFeature feature =
    new SchemaValidationFeature(MyErrorHandler.class);
  HelloWorldPortType port = service.getHelloWorldPortTypePort(feature);

4.10 JWS Programming Best Practices

The following list provides some best practices when programming the JWS file:

- When you create a document-literal-bare web service, use the @WebParam JWS
  annotation to ensure that all input parameters for all operations of a given web
  service have a unique name. Because of the nature of document-literal-bare web
  services, if you do not explicitly use the @WebParam annotation to specify the name
  of the input parameters, WebLogic Server creates one for you and run the risk of
duplicating the names of the parameters across a web service.

- In general, document-literal-wrapped web services are the most interoperable type
  of web service.

- Use the @WebResult JWS annotation to explicitly set the name of the returned
  value of an operation, rather than always relying on the hard-coded name return,
  which is the default name of the returned value if you do not use the @WebResult
  annotation in your JWS file.
This chapter describes how to use Java Architecture for XML Binding (JAXB) data binding.

This chapter includes the following topics:

- Section 5.1, "Overview of Data Binding Using JAXB"
- Section 5.2, "Developing the JAXB Data Binding Artifacts"
- Section 5.3, "Standard Data Type Mapping"
- Section 5.4, "Customizing Java-to-XML Schema Mapping Using JAXB Annotations"
- Section 5.5, "Customizing XML Schema-to-Java Mapping Using Binding Declarations"
- Section 5.6, "Using the Glassfish RI JAXB Data Binding and JAXB Providers"

5.1 Overview of Data Binding Using JAXB

With the emergence of XML as the standard for exchanging data across disparate systems, web service applications need a way to access data that are in XML format directly from the Java application. Specifically, the XML content needs to be converted to a format that is readable by the Java application. Data binding describes the conversion of data between its XML and Java representations.

JAX-WS uses JAXB, described at http://jcp.org/en/jsr/detail?id=222, to manage all of the data binding tasks. Specifically, JAXB binds Java method signatures and WSDL messages and operations and allows you to customize the mapping while automatically handling the runtime conversion. This makes it easy for you to incorporate XML data and processing functions in applications based on Java technology without having to know much about XML.

The following figure shows the JAXB data binding process.
As shown in the previous figure, the JAXB data binding process consists of the following tasks:

- **Bind**—Binds XML Schema to *schema-derived JAXB Java classes*, or value classes. Each class provides access to the content via a set of JavaBean-style access methods (that is, `get` and `set`). Binding is managed by the JAXB *schema compiler*.

- **Unmarshal**—Converts the XML document to create a tree of Java program elements, or objects, that represent the content and organization of the document that can be accessed by your Java code. In the content tree, complex types are mapped to value classes. Attribute declarations or elements with simple types are mapped to properties or fields within the value class and you can access the values for them using `get` and `set` methods. Unmarshalling is managed by the JAXB binding framework.

- **Marshal**—Converts the Java objects back to XML content. In this case, the Java methods that are deployed as WSDL operations determine the schema components in the `wsdl:types` section. Marshalling is managed by the JAXB binding framework.

You can use the JAXB binding language to define custom binding declarations or specify JAXB annotations to control the conversion of data between XML and Java.

WebLogic Server provides two data binding and JAXB providers:

- EclipseLink MOXy, the default in this release of WebLogic Server, is a fully compliant JAXB implementation. In addition to offering the standard JAXB features, EclipseLink MOXy provides useful extensions, such as the ability to use an external metadata file to configure the equivalent of JAXB annotations without modifying the Java source it refers to, and XPath based mapping. The JAXB enhancements can be used in the annotations on a service endpoint interface (SEI) or one of the value types used by the SEI. Users of JAXB in standalone mode can also take advantage of these features.

Some of the additional extensions offered by EclipseLink MOXy include:

- Extensions for mapping JPA entities to XML
- Bidirectional mapping
- Virtual properties
- Ability to bootstrap from metadata and generate in-memory domain classes (Dynamic MOXy)
Developing the JAXB Data Binding Artifacts

For a web service, the EclipseLink MOXy extensions can be leveraged on the server side only, and only in the Java to WSDL scenario, in which the SEI and value types can use the extended EclipseLink functionality. For more information about these extensions and EclipseLink MOXy, see The EclipseLink MOXy (JAXB) User’s Guide at http://wiki.eclipse.org/EclipseLink/UserGuide/MOXy.

No configuration is required to use the EclipseLink MOXy providers.

- Glassfish RI JAXB, which is the default Glassfish JAXB implementation, and was the default JAXB offering in WebLogic Server in previous releases. The Glassfish RI JAXB proprietary features will not work with EclipseLink MOXy. If desired, you can enable the Glassfish RI JAXB data binding and JAXB providers at the server or application level. For more information, see “Using the Glassfish RI JAXB Data Binding and JAXB Providers” on page 5-24.

The following sections describe how to use JAXB data binding with WebLogic Server and how to configure the Glassfish RI JAXB providers if desired:

- Section 5.2, "Developing the JAXB Data Binding Artifacts"—Describes how to develop the JAXB data binding artifacts using WebLogic Server.
- Section 5.3, "Standard Data Type Mapping"—Describes the standard built-in and user-defined data types that are supported.
- Section 5.5, "Customizing XML Schema-to-Java Mapping Using Binding Declarations"—Describes how you can control and customize the XML Schema-to-Java mapping using binding declarations that are defined in a separate file or embedded inline.
- Section 5.6, "Using the Glassfish RI JAXB Data Binding and JAXB Providers"—Describes the global server-level and application-level procedures required to configure the Glassfish RI JAXB Data Binding and JAXB providers instead of the default EclipseLink MOXy JAXB providers.

5.2 Developing the JAXB Data Binding Artifacts

The steps to develop the JAXB data binding artifacts using WebLogic Server depend on whether you are starting from a Java class file or a WSDL.

- Start from Java: Using this programming model, you create the Java classes. At run-time, JAXB *marshals* the Java objects to generate the XML content which is then packaged in a SOAP message and sent as a web service request or response.

  To control the Java-to-XML mapping, you include JAXB annotations in your JWS file, as described in Section 5.4, "Customizing Java-to-XML Schema Mapping Using JAXB Annotations." If no customizations are required, JAXB uses the standard built-in and user-defined data type mapping as described in the following sections: Section 5.3.1.2, "Java-to-XML Mapping for Built-In Data Types" and Section 5.3.2.2, "Supported Java User-Defined Data Types."

  For more information about this programming model, see Section 3.3, "Developing WebLogic Web Services Starting From Java: Main Steps."

- Start from WSDL: Using this programming model, the XML Schemas exist and JAXB *unmarshals* the XML document to generate the Java objects.
To control the XML-to-Java mapping, you can define custom binding declarations within the WSDL or XML Schema, or in an external file, as described in Section 5.5, "Customizing XML Schema-to-Java Mapping Using Binding Declarations." If no customizations are required, the standard built-in and user-defined data type mapping as described in the following sections:

Section 5.3.1.1, "XML-to-Java Mapping for Built-in Data Types" and Section 5.3.2.1, "Supported XML User-Defined Data Types."

For more information about this programming model, see Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps."

Please note, when invoking the jwsc, wsdlc, or clientgen Ant tasks described in these procedures:

- You must specify the type="JAXWS" attribute to generate a JAX-WS web service and JAXB binding artifacts. For jwsc, you specify the type attribute as part of the <jws> child element.
- You can optionally specify the <binding> child element to specify a customizations file that contains JAX-WS and JAXB data binding customizations. For information about creating a customizations file, see Section 5.5, "Customizing XML Schema-to-Java Mapping Using Binding Declarations." If no customizations are required, JAXB uses the standard built-in and user-defined data type mappings described in Section 5.3, "Standard Data Type Mapping."

For more information about the jwsc, wsdlc, or clientgen Ant tasks, see "Ant Task Reference" in WebLogic Web Services Reference for Oracle WebLogic Server.

5.3 Standard Data Type Mapping

WebLogic web services support a full set of built-in XML Schema, Java, and SOAP types, as specified by the JSR 222: Java™ Architecture for XML Binding (JAXB) 2.0 specification at http://jcp.org/en/jsr/detail?id=222, that you can use in your web service operations without performing any additional programming steps. Built-in data types are those such as integer, string, and time. Additionally, you can use a variety of user-defined XML and Java data types as input parameters and return values of your web service. User-defined data types are those that you create from XML Schema or Java building blocks, such as <xsd:complexType> or JavaBeans. The WebLogic web services Ant tasks, such as jwsc and clientgen, automatically generate the data binding artifacts needed to convert the user-defined data types between their XML and Java representations. The XML representation is used in the SOAP request and response messages, and the Java representation is used in the JWS that implements the web service.

The following sections describe the built-in and user-defined data types that are supported by JAXB:

- Section 5.3.1, "Supported Built-In Data Types"
- Section 5.3.2, "Supported User-Defined Data Types"

5.3.1 Supported Built-In Data Types

The following sections describe the built-in data types supported by WebLogic web services and the mapping between their XML and Java representations. As long as the data types of the parameters and return values of the back-end components that implement your web service are in the set of built-in data types, WebLogic Server automatically converts the data between XML and Java.
When using user-defined data types, then you must create the data binding artifacts that convert the data between XML and Java. WebLogic Server includes the `jwsc` and `wsdlc` Ant tasks that can automatically generate the data binding artifacts for most user-defined data types. See Section 5.3.2, "Supported User-Defined Data Types" for a list of supported XML and Java data types.

### 5.3.1.1 XML-to-Java Mapping for Built-in Data Types

The following table lists alphabetically the supported XML Schema data types (target namespace [http://www.w3.org/2001/XMLSchema](http://www.w3.org/2001/XMLSchema)) and their corresponding Java data types. For a list of the supported user-defined XML data types, see Section 5.3.1.2, "Java-to-XML Mapping for Built-In Data Types.”

<table>
<thead>
<tr>
<th>XML Schema Data Type</th>
<th>Java Data Type (lower case indicates a primitive data type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>anySimpleType (for xsd:element of this type)</td>
<td>java.lang.Object</td>
</tr>
<tr>
<td>anySimpleType (for xsd:attribute of this type)</td>
<td>java.lang.String</td>
</tr>
<tr>
<td>base64Binary</td>
<td>byte[]</td>
</tr>
<tr>
<td>boolean</td>
<td>boolean</td>
</tr>
<tr>
<td>byte</td>
<td>byte</td>
</tr>
<tr>
<td>date</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>dateTime</td>
<td>javax.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>decimal</td>
<td>java.math.BigDecimal</td>
</tr>
<tr>
<td>double</td>
<td>double</td>
</tr>
<tr>
<td>duration</td>
<td>javax.xml.datatype.Duration</td>
</tr>
<tr>
<td>float</td>
<td>float</td>
</tr>
<tr>
<td>g</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>hexBinary</td>
<td>byte[]</td>
</tr>
<tr>
<td>int</td>
<td>int</td>
</tr>
<tr>
<td>integer</td>
<td>java.math.BigInteger</td>
</tr>
<tr>
<td>long</td>
<td>long</td>
</tr>
<tr>
<td>NOTATION</td>
<td>javax.xml.namespace.QName</td>
</tr>
<tr>
<td>QName</td>
<td>javax.xml.namespace.QName</td>
</tr>
<tr>
<td>short</td>
<td>short</td>
</tr>
<tr>
<td>string</td>
<td>java.lang.String</td>
</tr>
<tr>
<td>time</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>unsignedByte</td>
<td>short</td>
</tr>
<tr>
<td>unsignedInt</td>
<td>long</td>
</tr>
<tr>
<td>unsignedShort</td>
<td>int</td>
</tr>
</tbody>
</table>

The following example, borrowed from the JAXB specification, shows an example of the default XML-to-Java binding.
5.3.1.1 XML Schema

```xml
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <xsd:element name="purchaseOrder" type="PurchaseOrderType"/>
  <xsd:complexType name="PurchaseOrderType">
    <xsd:sequence>
      <xsd:element name="shipTo" type="USAddress"/>
      <xsd:element name="billTo" type="USAddress"/>
      <xsd:element ref="comment" minOccurs="0"/>
      <xsd:element name="items" type="Items"/>
    </xsd:sequence>
    <xsd:attribute name="orderDate" type="xsd:date"/>
  </xsd:complexType>
  <xsd:complexType name="USAddress">
    <xsd:sequence>
      <xsd:element name="name" type="xsd:string"/>
      <xsd:element name="street" type="xsd:string"/>
      <xsd:element name="city" type="xsd:string"/>
      <xsd:element name="state" type="xsd:string"/>
      <xsd:element name="zip" type="xsd:decimal"/>
    </xsd:sequence>
    <xsd:attribute name="country" type="xsd:NMTOKEN" fixed="US"/>
  </xsd:complexType>
  <xsd:complexType name="Items">
    <xsd:sequence>
      <xsd:element name="item" minOccurs="1" maxOccurs="unbounded">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:element name="productName" type="xsd:string"/>
            <xsd:element name="quantity">
              <xsd:simpleType>
                <xsd:restriction base="xsd:positiveInteger">
                  <xsd:maxExclusive value="100"/>
                </xsd:restriction>
              </xsd:simpleType>
            </xsd:element>
            <xsd:element name="USPrice" type="xsd:decimal"/>
            <xsd:element ref="comment" minOccurs="0"/>
            <xsd:element name="shipDate" type="xsd:date" minOccurs="0"/>
          </xsd:sequence>
          <xsd:attribute name="partNum" type="SKU" use="required"/>
        </xsd:complexType>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <!-- Stock Keeping Unit, a code for identifying products -->
  <xsd:simpleType name="SKU">
    <xsd:restriction base="xsd:string">
      <xsd:pattern value="\d{3}-[A-Z]{2}"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:schema>
```

5.3.1.2 Default Java Binding

```java
import javax.xml.datatype.XMLGregorianCalendar;
import java.util.List;
public class PurchaseOrderType {
  USAddress getShipTo(){...}
  void setShipTo(USAddress){...}
  USAddress getBillTo(){...}
}```
void setBillTo(USAddress){...}
/** Optional to set Comment property. */
String getComment(){...}
void setComment(String){...}
Items getItems(){...}
void setItems(Items){...}
XMLGregorianCalendar getOrderDate()
void setOrderDate(XMLGregorianCalendar)
};
public class USAddress {
    String getName(){...}
    void setName(String){...}
    String getStreet(){...}
    void setStreet(String){...}
    String getCity(){...}
    void setCity(String){...}
    String getState(){...}
    void setState(String){...}
    int getZip(){...}
    void setZip(int){...}
    static final String COUNTRY="USA";
};
public class Items {
    public class ItemType {
        String getProductName(){...}
        void setProductName(String){...}
        /** Type constraint on Quantity setter value 0..99.*/
        int getQuantity(){...}
        void setQuantity(int){...}
        float getUSPrice(){...}
        void setUSPrice(float){...}
        /** Optional to set Comment property. */
        String getComment(){...}
        void setComment(String){...}
        XMLGregorianCalendar getShipDate();
        void setShipDate(XMLGregorianCalendar);
        /** Type constraint on PartNum setter value \d{3}-[A-Z]{2}.*/
        String getPartNum(){...}
        void setPartNum(String){...}
    }
    /** Local structural constraint 1 or more instances of Items.ItemType.*/
List<Items.ItemType> getItem(){...}
}
public class ObjectFactory {
    // type factories
    Object newInstance(Class javaInterface){...}
    PurchaseOrderType createPurchaseOrderType(){...}
    USAddress createUSAddress(){...}
    Items createItems(){...}
    Items.ItemType createItemsItemType(){...}
    // element factories
    JAXBElement<PurchaseOrderType>createPurchaseOrder(PurchaseOrderType){...}
    JAXBElement<String> createComment(String value){...}
}

5.3.1.2 Java-to-XML Mapping for Built-In Data Types
The following table lists alphabetically the supported Java data types and their equivalent XML Schema data types. For a list of the supported user-defined Java data types, see Section 5.3.2.2, "Supported Java User-Defined Data Types."
5.3.2 Supported User-Defined Data Types

The tables in the following sections list the user-defined XML and Java data types for which the jwsc and wsdlc Ant tasks can automatically generate data binding artifacts, such as the corresponding Java or XML representation.

If your XML or Java data type is not listed in these tables, and it is not one of the built-in data types listed in Section 5.3.1, "Supported Built-In Data Types," then you must create the user-defined data type artifacts manually.

5.3.2.1 Supported XML User-Defined Data Types

The following table lists the XML Schema data types supported by the jwsc and wsdlc Ant tasks and their equivalent Java data type or mapping mechanism.

<table>
<thead>
<tr>
<th>XML Schema Data Type</th>
<th>Equivalent Java Data Type or Mapping Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;xsd:complexType&gt; with elements of both simple and complex types.</td>
<td>JavaBean</td>
</tr>
</tbody>
</table>
5.3.2.2 Supported Java User-Defined Data Types

The following table lists the Java user-defined data types supported by the jwsc and wsdlc Ant tasks and their equivalent XML Schema data type.

<table>
<thead>
<tr>
<th>Java Data Type</th>
<th>Equivalent XML Schema Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>JavaBean whose properties are any supported data type.</td>
<td><code>&lt;xsd:complexType&gt;</code> whose content model is a <code>&lt;xsd:sequence&gt;</code> of elements corresponding to JavaBean properties.</td>
</tr>
<tr>
<td>Array and multidimensional array of any supported data type (when used as a JavaBean property)</td>
<td>An element in a <code>&lt;xsd:complexType&gt;</code> with the <code>maxOccurs</code> attribute set to unbounded.</td>
</tr>
<tr>
<td><code>java.lang.Object</code></td>
<td><code>&lt;xsd:anyType&gt;</code></td>
</tr>
<tr>
<td><code>java.util.Collection</code></td>
<td>Literal Array</td>
</tr>
</tbody>
</table>

**Table 5–4 Supported Java User-defined Data Types**

**Table 5–3 (Cont.) Supported User-defined XML Schema Data Types**

<table>
<thead>
<tr>
<th>XML Schema Data Type</th>
<th>Equivalent Java Data Type or Mapping Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;xsd:complexType&gt;</code> with simple content.</td>
<td>JavaBean</td>
</tr>
<tr>
<td><code>&lt;xsd:attribute&gt;</code> in <code>&lt;xsd:complexType&gt;</code></td>
<td>Property of a JavaBean</td>
</tr>
<tr>
<td>Derivation of new simple types by restriction of an existing simple type.</td>
<td>Equivalent Java data type of simple type.</td>
</tr>
<tr>
<td>Facets used with restriction element.</td>
<td>Facets not enforced during serialization and deserialization.</td>
</tr>
<tr>
<td><code>&lt;xsd:list&gt;</code></td>
<td>Array of the list data type.</td>
</tr>
<tr>
<td>Array derived from <code>soapenc:Array</code> by restriction using the <code>wsdl:arrayType</code> attribute.</td>
<td>Array of the Java equivalent of the <code>arrayType</code> data type.</td>
</tr>
<tr>
<td>Array derived from <code>soapenc:Array</code> by restriction.</td>
<td>Array of Java equivalent.</td>
</tr>
<tr>
<td>Derivation of a complex type from a simple type.</td>
<td>JavaBean with a property called <code>_value</code> whose type is mapped from the simple type according to the rules in this section.</td>
</tr>
<tr>
<td><code>&lt;xsd:anyType&gt;</code></td>
<td><code>java.lang.Object</code></td>
</tr>
<tr>
<td><code>&lt;xsd:any&gt;</code></td>
<td><code>java.lang.Object</code></td>
</tr>
<tr>
<td><code>&lt;xsd:any[]&gt;</code></td>
<td><code>java.lang.Object</code></td>
</tr>
<tr>
<td><code>&lt;xsd:union&gt;</code></td>
<td>Common parent type of union members.</td>
</tr>
<tr>
<td><code>&lt;xsi:nil&gt;</code> and <code>&lt;xsd:nillable&gt;</code> attribute</td>
<td>Java null value. If the XML data type is built-in and usually maps to a Java primitive data type (such as <code>int</code> or <code>short</code>), then the XML data type is actually mapped to the equivalent object wrapper type (such as <code>java.lang.Integer</code> or <code>java.lang.Short</code>).</td>
</tr>
<tr>
<td>Derivation of complex types</td>
<td>Mapped using Java inheritance.</td>
</tr>
<tr>
<td>Abstract types</td>
<td>Abstract Java data type.</td>
</tr>
</tbody>
</table>
5.4 Customizing Java-to-XML Schema Mapping Using JAXB Annotations

If required, you can override the default binding rules for Java-to-XML Schema mapping using JAXB annotations. Table 5–5 summarizes the JAXB mapping annotations that you can include in your JWS file to control how the Java objects are mapped to XML. Each of these annotations are available with the javax.xml.bind.annotation package, described at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/package-summary.html.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@XmlAccessorType</td>
<td>Specifies whether fields or properties are mapped by default. See Section 5.4.2, &quot;Specifying Default Serialization of Fields and Properties (@XmlAccessorType Annotation).&quot;</td>
</tr>
<tr>
<td>@XmlElement</td>
<td>Maps a property contained in a class to a local element in the XML Schema complex type to which the containing class is mapped. See Section 5.4.3, &quot;Mapping Properties to Local Elements (@XmlElement).&quot;</td>
</tr>
<tr>
<td>@XMLMimeType</td>
<td>Associates the MIME type that controls the XML representation of the property with a textual representation, such as image/jpeg. See Section 5.4.4, &quot;Specifying the MIME Type (@XmlMimeType Annotation).&quot;</td>
</tr>
<tr>
<td>@XmlRootElement</td>
<td>Maps a top-level class to a global element in the XML Schema that is used by the WSDL of the web service. See Section 5.4.5, &quot;Mapping a Top-level Class to a Global Element (@XmlRootElement).&quot;</td>
</tr>
<tr>
<td>@XmlSeeAlso</td>
<td>Binds other classes when binding the current class. See Section 5.4.6, &quot;Binding a Set of Classes (@XmlSeeAlso).&quot;</td>
</tr>
<tr>
<td>@XmlType</td>
<td>Maps a class or enum type to an XML Schema type. See Section 5.4.7, &quot;Mapping a Value Class to a Schema Type (@XmlType).&quot;</td>
</tr>
</tbody>
</table>

The default mapping of Java objects to XML Schema for the supported built-in and user-defined types are listed in the following sections:

- Section 5.3.1.2, "Java-to-XML Mapping for Built-In Data Types"
- Section 5.3.2.2, "Supported Java User-Defined Data Types"
5.4.1 Example of JAXB Annotations

The following provides an example of the JAXB annotations.

```java
@XmlRootElement(name = "ComplexService", namespace = "http://examples.org")
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "basicStruct", propOrder = {
    "intValue",
    "stringArray",
    "stringValue"
})
public class BasicStruct {
    protected int intValue;
    @XmlElement(nillable = true)
    protected List<String> stringArray;
    protected String stringValue;
    public int getIntValue() {
        return intValue;
    }
    public void setIntValue(int value) {
        this.intValue = value;
    }
    public List<String> getStringArray() {
        if (stringArray == null) {
            stringArray = new ArrayList<String>();
        }
        return this.stringArray;
    }
    public String getStringValue() {
        return stringValue;
    }
    public void setStringValue(String value) {
        this.stringValue = value;
    }
}
```

5.4.2 Specifying Default Serialization of Fields and Properties (@XmlAccessorType Annotation)

The `@XmlAccessorType` annotation specifies whether fields or properties are mapped by default. The annotation can be specified for the following Java program elements:

- Package
- Top-level class

The `@XmlAccessorType` can be specified with the `@XmlType` (see Section 5.4.7, "Mapping a Value Class to a Schema Type (@XmlType)") and `@XmlRootElement` (see Section 5.4.5, "Mapping a Top-level Class to a Global Element (@XmlRootElement)") annotations.

The following table lists the optional element that can be passed to the `@XmlAccessorType` annotation.
5.4.3 Mapping Properties to Local Elements (@XmlElement)

The `@XmlElement` annotation maps a property contained in a class to a local element in the XML Schema complex type to which the containing class is mapped. The annotation can be specified for the following Java program elements:

- JavaBean property
- Non-static, non-transient field

The following table lists the annotation elements that can be passed to the `@XmlElement` annotation.

For more information, see the `javax.xml.bind.annotation.XmlElement` Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/XmlElement.html. An example is provided in Section 5.4.1, "Example of JAXB Annotations."

### Table 5–6 Optional Element for `@XMLAccessType` Annotation

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
</table>
| value   | Specifies `XMLAccessType.value`, where `value` can be one of the following values:  
  - FIELD—Fields are bound to XML.  
  - PROPERTY—JavaBean properties and annotated fields are bound to XML.  
  - PUBLIC_MEMBER—Public and annotated fields, and JavaBean properties are bound to XML. This is the default.  
  - NONE—Only annotated fields and properties are bound to XML. |

### Table 5–7 Optional Element Summary for `@XMLElement` Annotation

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Local name of the XML element that represents the property of a JavaBean. This element defaults to the JavaBean property name.</td>
</tr>
<tr>
<td>namespace</td>
<td>Namespace of the XML element that represents the property of a JavaBean. By default, the namespace is derived from the namespace of the containing class.</td>
</tr>
<tr>
<td>nillable</td>
<td>Customize the element declaration to be nillable.</td>
</tr>
</tbody>
</table>

For more information, see the `javax.xml.bind.annotation.XmlElement` Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/XmlElement.html.

5.4.4 Specifying the MIME Type (@XmlMimeType Annotation)

The `@XmlMimeType` annotation specifies the MIME type that controls the XML representation of the property. The annotation can be specified for data types, such as `Image` or `Source`, that are bound to the `xsd:base64Binary` binary in XML.

The following table lists the required element that can be passed to the `@XmlMimeType` annotation.

### Table 5–8 Required Element for `@XMLMimeType` Annotation

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the textual representation of the MIME type, such as <code>image/jpeg</code>, <code>text/xml</code>, and so on.</td>
</tr>
</tbody>
</table>
For more information, see the javax.xml.bind.annotation.XmlMimeType Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/XmlMimeType.html.

5.4.5 Mapping a Top-level Class to a Global Element (@XmlRootElement)

The @XmlRootElement annotation maps a top-level class to a global element in the XML Schema that is used by the WSDL of the web service. The annotation can be specified for the following Java program elements:

- Top-level class
- Enum type

The @XmlRootElement can be specified with the @XmlType (see Section 5.4.7, "Mapping a Value Class to a Schema Type (@XmlType)") and @XmlAccessorType (see Section 5.4.2, "Specifying Default Serialization of Fields and Properties (@XmlAccessorType Annotation)") annotations.

The following table lists the optional elements that can be passed to the @XmlRootElement annotation.

<table>
<thead>
<tr>
<th>Table 5–9 Optional Elements for @XmlRootElement Annotation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element</strong></td>
</tr>
<tr>
<td>name</td>
</tr>
<tr>
<td>namespace</td>
</tr>
</tbody>
</table>

For more information, see the javax.xml.bind.annotation.XmlRootElement Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/XmlRootElement.html. An example is provided in Section 5.4.1, "Example of JAXB Annotations."

5.4.6 Binding a Set of Classes (@XmlSeeAlso)

The @XmlSeeAlso annotation binds a list of classes when binding the current class. The following table lists the optional element that can be passed to the @XmlSeeAlso annotation.

<table>
<thead>
<tr>
<th>Table 5–10 Optional Element for @XmlSeeAlso Annotation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element</strong></td>
</tr>
<tr>
<td>value</td>
</tr>
</tbody>
</table>

5.4.7 Mapping a Value Class to a Schema Type (@XmlType)

The @XmlType annotation maps a class or enum type to an XML Schema type. The type can be a simple or complex type. The annotation can be specified for the following Java program elements:

- Top-level class
- Enum type

The @XmlType can be specified with the @XmlRootElement (see Section 5.4.5, "Mapping a Top-level Class to a Global Element (@XmlRootElement)") and @XmlAccessorType (see Section 5.4.2, "Specifying Default Serialization of Fields and Properties (@XmlAccessorType Annotation)") annotations.
The following table lists the optional elements that can be passed to the @XmlType annotation.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Name of the XML Schema type to which the class is mapped.</td>
</tr>
<tr>
<td>namespace</td>
<td>Name of the target namespace of the XML Schema type. By default, the target namespace to which the package containing the class is mapped.</td>
</tr>
<tr>
<td>propOrder</td>
<td>List of JavaBean property names defined in a class. The list defines an order for the XML Schema elements when the class is mapped to an XML Schema complex type. Each name in the list is the name of a Java identifier of the JavaBean property. All of the JavaBean properties must be listed.</td>
</tr>
</tbody>
</table>

For more information, see the javax.xml.bind.annotation.XmlType Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/bind/annotation/XmlType.html. An example is provided in Section 5.4.1, "Example of JAXB Annotations."

5.5 Customizing XML Schema-to-Java Mapping Using Binding Declarations

Due to the distributed nature of a WSDL, you cannot always control or change its contents to meet the requirements of your application. For example, the WSDL may not be owned by you or it may already be in use by your partners, making changes impractical or impossible.

If directly editing the WSDL is not an option, you can customize how the WSDL components are mapped to Java objects by specifying custom binding declarations. You can use binding declarations to control specific features, as well, such as asynchrony, wrapper style, and so on, and to control the JAXB data binding artifacts that are produced by customizing the XML Schema.

You can define binding declarations in one of the following ways:

- Create an external binding declarations file that contains all binding declarations for a specific WSDL or XML Schema document. See Section 5.5.1, "Creating an External Binding Declarations File."

  **Note:** If customizations are required, Oracle recommends this method to maintain flexibility by keeping the customizations separate from the WSDL or XML Schema document.

- Embed binding declarations within the WSDL or XML Schema document. See Section 5.5.2, "Embedding Binding Declarations."

The binding declarations are semantically equivalent regardless of which method you choose.

Custom binding declarations are associated with a scope, as shown in the following figure.
The following table describes the meaning of each scope.

### Table 5–12 Scope for Custom Binding Declarations

<table>
<thead>
<tr>
<th>Scope</th>
<th>Definition</th>
</tr>
</thead>
</table>
| **Global scope** | Describes customization values with global scope. Specifically: |%
|               | ■ For JAX-WS binding declarations, describes customization values that are defined as part of the root element, as described in Section 5.5.1.1.1, “Specifying the Root Element.” |%
|               | ■ For JAXB annotations, describes customization values that are contained within the `<globalBindings>` binding declaration. Global scope values apply to all of the schema elements in the source schema as well as any schemas that are included or imported. |%
| **Schema scope** | Describes JAXB customization values that are contained within the `<schemaBindings>` binding declaration. Schema scope values apply to the elements in the target namespace of a schema. |
| **Definition scope** | Describes JAXB customization values that are defined in binding declarations of a type definition or global declaration. Definition scope values apply to elements that reference the type definition or global declaration. |
| **Component scope** | Describes customization values that apply to the WSDL or schema element that was annotated. |

Scopes for custom binding declarations adhere to the following inheritance and overriding rules:

- **Inheritance**—Customization values are inherited from the top down. For example, a WSDL element (JAX-WS) in a component scope inherits a customization value defined in global scope. A schema element (JAXB) in a component scope inherits a customization value defined in global, schema, and definition scopes.

- **Overriding**—Customization values are overridden from the bottom up. For example, a WSDL element (JAX-WS) in a component scope overrides a customization value defined in global scope. A schema element (JAXB) in a component scope overrides a customization value defined in definition, schema, and global scopes.

The following sections describe how to create custom binding declarations and describe the standard custom binding declarations:

- Section 5.5.1, "Creating an External Binding Declarations File"
5.5.1 Creating an External Binding Declarations File

Create an external binding declarations file that contains all binding declarations for a specific WSDL or XML Schema document. Then, pass the binding declarations file to the <binding> child element of the wsdlc, jwsc, or clientgen Ant task.

The following sections describe:

- Section 5.5.1.1, "Creating an External Binding Declarations File Using JAX-WS Binding Declarations"
- Section 5.5.1.2, "Creating an External Binding Declarations File Using JAXB Binding Declarations"

5.5.1.1 Creating an External Binding Declarations File Using JAX-WS Binding Declarations

The following sections describe how to specify the root and child elements of the JAX-WS binding declarations file. For information about the custom binding declarations that you can define, see Section 5.5.3, "JAX-WS Custom Binding Declarations."

5.5.1.1.1 Specifying the Root Element

The jaxws:bindings declaration is the root of all other binding declarations and defines the location of the WSDL file and the namespace to which the XML Schema conforms:


The format of the root declaration is as follows:

```
<jaxws:bindings
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
    xmlns:jaxws="http://java.sun.com/xml/ns/jaxws">

uri_of_wsd1 specifies the URI of the WSDL file.

The package, wrapper style, and asynchronous mapping customizations, defined in Table 5–5, can be globally defined as part of the root binding declaration in the external customization file. Global bindings apply to the entire scope of the wsdl:definition in the WSDL referenced by the wsdlLocation attribute.

The following provides an example of the root binding element that defines the package name, wrapper style, and asynchronous mapping customizations.

```
<jaxws:bindings
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
    xmlns:jaxws="http://java.sun.com/xml/ns/jaxws">
  <package name="example.webservices.simple.simpleservice">
    <enableWrapperStyle>true</enableWrapperStyle>
```
5.5.1.1.2 Specifying Child Elements The root <jaxws:bindings> element can contain child elements. You specify the WSDL node that is being customized by passing an XPath expression in the node attribute.

An XML Schema inlined inside a compiled WSDL file can be customized by using standard JAXB bindings. For more information, see "XML Schema Customization" in JAX-WS WSDL Customizations at http://jax-ws.java.net/nonav/2.1.2/docs/customizations.html. For information about the custom JAXB binding declarations that you can define, see Section 5.5.4, "JAXB Custom Binding Declarations."

For example, the following example defines the package name as examples.webservices.complex.complexservice for the <wsdl:definitions> node of the WSDL document.

```xml
<jaxws:bindings
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
    wsdlLocation="http://localhost:7001/simple/SimpleService?WSDL
    xmlns:jaxws="http://java.sun.com/xml/ns/jaxws">
    <jaxws:bindings
        node="wsdl:definitions"
        xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
        <jaxws:package name="examples.webservices.simple.simpleservice"/>
    </jaxws:bindings>
</jaxws:bindings>
```

5.5.1.2 Creating an External Binding Declarations File Using JAXB Binding Declarations

The JAXB binding declarations file is an XML document that conforms to the XML Schema for the following namespace: http://java.sun.com/xml/ns/jaxb. The following sections describe how to specify the root and child elements of the JAXB binding declarations file. For information about the custom binding declarations that you can define, see Section 5.5.4, "JAXB Custom Binding Declarations."

5.5.1.2.1 Specifying the Root Element The <jaxb:bindings> declaration is the root of all other binding declarations. The format of the root declaration is as follows:

```xml
<jaxb:bindings
    schemaLocation="uri_of_schema">


5.5.1.2.2 Specifying Child Elements The root <jaxb:bindings> element can contain child elements. You specify the schema node that is being customized by passing an XPath expression in the node attribute.

For example, the following example defines the package name as examples.webservices.simple.simpleservice.

```xml
<jaxb:bindings
    schemaLocation="simpleservice.xsd">
    <jaxb:bindings
        node="/xs:simpleType[@name='value1']">
        <jaxb:package name="examples.webservices.simple.simpleservice"/>
    </jaxb:bindings>
</jaxb:bindings>
```
5.5.2 Embedding Binding Declarations

You can embed binding declarations in a WSDL file using one of the following methods:

- Embed a JAX-WS or JAXB binding declaration in the WSDL file using the `jaxws:bindings` element as a WSDL extension. See Section 5.5.2.1, "Embedding JAX-WS or JAXB Binding Declarations in the WSDL File."

- Embed a JAXB binding declaration in the XML Schema as part of an `<appinfo>` element. See Section 5.5.2.2, "Embedding JAXB Binding Declarations in the XML Schema."

5.5.2.1 Embedding JAX-WS or JAXB Binding Declarations in the WSDL File

You can embed a binding declaration in the WSDL file using the `jaxws:bindings` element as a WSDL extension. For information about the custom binding declarations that you can define, see Section 5.5.3, "JAX-WS Custom Binding Declarations."

For example, the following example defines the class name as `SimpleService` for the `SimpleServiceImpl` service endpoint interface (or port).

```xml
<wsdl:portType name="SimpleServiceImpl">
  <jaxws:bindings xmlns:jaxws="http://java.sun.com/xml/ns/jaxws">
    <jaxws:class name="SimpleService"/>
  </jaxws:bindings>
</wsdl:portType>
```

If this binding declaration had not been specified, the class name of the service endpoint interface would be set to the `wsdl:portType` name—`SimpleServiceImpl`—by default.

An XML Schema inlined inside a compiled WSDL file can be customized by using standard JAXB bindings. For more information, see "XML Schema Customizations" in JAX-WS WSDL Customizations, which is available at http://jax-ws.java.net/nonav/2.1.2/docs/customizations.html. For information about the custom JAXB binding declarations that you can define, see Section 5.5.4, "JAXB Custom Binding Declarations."

5.5.2.2 Embedding JAXB Binding Declarations in the XML Schema

You can embed a JAXB custom declaration within the `<appinfo>` element of the XML Schema, as illustrated below.

```xml
<xs:annotation>
  <xs:appinfo>
    <binding declaration/>
  </xs:appinfo>
</xs:annotation>
```

For example, the following defines the package name for the schema:

```xml
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.w3.org/2001/XMLSchema"
  xmlns:jaxb="http://java.sun.com/xml/ns/jaxb"
  jaxb:version="2.0">
  <annotation>
    <appinfo>
      <jaxb:schemaBindings>
        <jaxb:package name="example.webservices.simple.simpleservice"/>
      </jaxb:schemaBindings>
    </appinfo>
  </annotation>
</schema>
```
5.5.3 JAX-WS Custom Binding Declarations

The following table summarizes the typical JAX-WS customizations. For a complete list of JAX-WS custom binding declarations, see JAX-WS WSDL Customization at http://jax-ws.java.net/nonav/2.1.2/docs/customizations.html.

<table>
<thead>
<tr>
<th>Customization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package name</td>
<td>Use the jaxws:package binding declaration to define the package name. If you do not specify this customization, the wsdlc Ant task generates a package name based on the targetNamespace of the WSDL. This data binding customization is overridden by the packageName attribute of the wsdlc, jwsc, or clientgen Ant task. For more information, see &quot;wsdlc&quot; in the WebLogic Web Services Reference for Oracle WebLogic Server. This binding declaration can be specified as part of the root binding element, as described in Section 5.5.1, &quot;Creating an External Binding Declarations File,&quot; or on the wsdl:definitions node, as shown in the following example:</td>
</tr>
</tbody>
</table>

```xml
<bindings
  xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
  wsdlLocation= "http://localhost:7001/simple/SimpleService?WSDL"
  xmlns="http://java.sun.com/xml/ns/jaxws">
  <package name="example.webservices.simple.simpleService"/>
</bindings>
```
Wrapper-style rules

Use the jaxws:enablesWrapperStyle binding declaration to enable or disable the wrapper style rules that control how the parameter types and return types of a WSDL operation are generated.

This binding declaration can be specified as part of the root binding element, as described in Section 5.5.1, "Creating an External Binding Declarations File," or on one of the following nodes:

- wsdl:definitions—Applies to all wsdl:operations of all wsdl:portType attributes.
- wsdl:portType—Applies to all wsdl:operations in the wsdl:portType.
- wsdl:operation—Applies to the wsdl:operation only.

The following example disables the wrapper style rules for the wsdl:definitions node:

```xml
<bindings
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
    wsdlLocation="http://localhost:7001/simple/SimpleService?WSDL"
    xmlns="http://java.sun.com/xml/ns/jaxws">
    <bindings node="wsdl:definitions"
        xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
        <enableWrapperStyle>false</enableWrapperStyle>
    </bindings>
</bindings>
```

Asynchrony

Use the jaxws:enableAsyncMapping binding declaration to instruct the clientgen Ant task to generate asynchronous polling and callback operations along with the normal synchronous methods when it compiles a WSDL file.

This binding declaration can be specified as part of the root binding element, as described in Section 5.5.1, "Creating an External Binding Declarations File," or on one of the following nodes:

- wsdl:definitions—Applies to all wsdl:operations of all wsdl:portType attributes.
- wsdl:portType—Applies to all wsdl:operations in the wsdl:portType.
- wsdl:operation—Applies to the wsdl:operation only.

The following example disables asynchronous polling and callback operations:

```xml
<bindings
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
    wsdlLocation="http://localhost:7001/simple/SimpleService?WSDL"
    xmlns="http://java.sun.com/xml/ns/jaxws">
    <bindings node="wsdl:definitions"
        xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
        <enableAsyncMapping>false</enableAsyncMapping>
    </bindings>
</bindings>
```
### Table 5–13 (Cont.) JAX-WS Custom Binding Declarations

<table>
<thead>
<tr>
<th>Customization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider</td>
<td>Use the <code>jaxws:provider</code> binding declaration to mark the part as a provider interface. This binding declaration can be specified as part of the <code>wsdl:portType</code>. This binding declaration applies when you are developing a service starting from a WSDL file.</td>
</tr>
</tbody>
</table>

**Class name**

Use the `jaxws:class` binding declaration to define the class name. This binding declaration can be specified for one of the following nodes:

- `wsdl:portType`—Defines the interface class name.
- `wsdl:Fault`—Defines fault class names.
- `soap-headerfault`—Defines exception class names.
- `wsdl:service`—Defines the implementation class names.

The following example defines the class name for the implementation class.

```xml
<bindings node="wsdl:definitions/wsdl:service[@name='SimpleService']">
  <class name="myService"/>
</bindings>
```

**Method name**

Use the `jaxws:method` binding declaration to customize the generated Java method name of a service endpoint interface or the port accessor method in the generated Service class.

The following example defines the Java method name for the `wsdl:operation` `EchoHello`.

```xml
<bindings node="wsdl:definitions/wsdl:portType[@name='SimpleServiceImpl']/wsdl:operation[@name='EchoHello']">
  <method name="Greeting"/>
</bindings>
```

**Java parameter name**

Use the `jaxws:parameter` binding declaration to customize the parameter name of generated Java methods. This declaration can be used to change the method parameter of a `wsdl:operation` in a `wsdl:portType`.

The following example defines the Java method name for the `wsdl:operation` `echoHello`.

```xml
<bindings node="wsdl:definitions/wsdl:portType[@name='SimpleServiceImpl']/wsdl:operation[@name='EchoHello']">
  <method name="Hello">
    <parameter part="definitions/message[@name='EchoHello']/part[@name='parameters']" element="hello" name="greeting"/>
  </method>
</bindings>
```

**Javadoc**

Use the `jaxws:javadoc` binding declaration to specify Javadoc text for a package, class, or method.

For example, the following defines Javadoc at the method level.

```xml
<bindings node="wsdl:definitions/wsdl:portType[@name='SimpleServiceImpl']/wsdl:operation[@name='EchoHello']">
  <method name="Hello">
    <javadoc>Prints hello.</javadoc>
  </method>
</bindings>
```
5.5.4 JAXB Custom Binding Declarations

The following table lists the typical JAXB customizations.

Table 5–14  JAXB Custom Binding Declarations

<table>
<thead>
<tr>
<th>Customization</th>
<th>Description</th>
</tr>
</thead>
</table>
| Global bindings   | Use the `<globalBindings>` binding declaration to define binding declarations with global scope (see Figure 5–2). You can specify attributes and elements to the `<globalBindings>` binding declaration. For example, the following binding declaration defines: 
  - `collectionType` attribute that specifies a type class, `myArray`, that implements the `java.util.List` interface and that is used to represent all lists in the generated implementation. 
  - `generateIsSetMethod` attribute to generate the `isSet()` method corresponding to the getter and setter property methods. 
  - `javaType` element to customize the binding of an XML Schema atomic datatype to a Java datatype (built-in or application-specific). 
  ```xml
  <jaxb:globalBindings
    collectionType="java.util.myArray"
    generateIsSetMethod="false">
    <jaxb:javaType name="java.util.Date"
      xmlType="xsd:date">
    </jaxb:javaType>
  </jaxb:globalBindings>
  ```
| Schema bindings   | Use the `<schemaBindings>` binding declaration to define binding declarations with schema scope (see Figure 5–2). For an example, see the description of “Package name” in this table. |
Package name

Use the `<package>` element of the `<schemaBindings>` binding declaration (see Table 5–12) to define the package name for the schema.

If you do not specify this customization, the `wsdlc` Ant task generates a package name based on the `targetNamespace` of the WSDL. This data binding customization is overridden by the `packageName` attribute of the `wsdlc`, `jwsc`, or `clientgen` Ant task. For more information, see "wsdlc" in the WebLogic Web Services Reference for Oracle WebLogic Server.

For example, the following defines the package name for all JAXB classes generated from the `simpleservice.xsd` file:

```xml
<jaxb:bindings
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    schemaLocation="simpleservice.xsd"
    node="/xs:schema">
    <jaxb:schemaBindings>
        <jaxb:package name="examples.jaxb"/>
    </jaxb:schemaBindings>
</jaxb:bindings>
```

Class name

Use the `<class>` binding declaration to define the class name for a schema element.

The following example defines the class name for an `xsd:complexType`:

```xml
<xs:complexType name="ComplexType">
    <xs:annotation><xs:appinfo>
        <jaxb:javadoc>This is my class.</jaxb:javadoc>
    </xs:appinfo></xs:annotation>
</xs:complexType>
```

Java property name

Use the `<property>` binding declaration to define the property name for a schema element.

The following example shows how to define the Java property name:

```xml
<jaxb:bindings
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    node="/xs:schema">
    <jaxb:schemaBindings>
        <jaxb:property generateIsSetMethod="true"/>
    </jaxb:schemaBindings>
</jaxb:bindings>
```
5.6 Using the Glassfish RI JAXB Data Binding and JAXB Providers

The Glassfish RI JAXB data binding and JAXB providers provide the standard Glassfish JAXB implementation, and were the default JAXB providers in previous WebLogic Server releases. If desired, you can restore the Glassfish RI providers, either globally on the server, or on a per application basis.

Note that the JAXB data binding provider and the JAXB provider are two distinct entities, although both use EclipseLink MOXy as the default. The JAXB data binding provider is used by the web services tooling and runtime, and performs tasks such as WSDL generation from a Java endpoint, as in the JWS task, and the runtime marshalling and unmarshalling of the contents of the SOAP message. The JAXB provider, on the other hand, specifies which JAXBContext provider to use for all other JAXB-related tasks. Although the JAXB provider configuration does apply to some of the web services tooling, such as Java class generation from WSDL/schema files, it includes all other JAXB usage as well. These two providers can be configured independently. For example, you could retain EclipseLink MOXy for data binding, but revert to the Glassfish RI JAXB provider for other JAXB tasks.

The data binding and JAXB providers are configured using the following Java Service Provider Interface (SPI) files in \$MW_HOME/oracle_common/modules/com.oracle.webservices.wls.wls-ws-metainf-services-impl.jar:

- META-INF/services/com.sun.xml.ws.spi.db.BindingContextFactory
- META-INF/services/javax.xml.bind.JAXBContext

Note: In 12.1.2.0, the providers were located in \$MW_HOME/oracle_common/modules/com.oracle.webservices.wls.wls-ws-metainf-services_2.0.0.0.jar. In 12.1.1.0, the providers were located in \$WL_HOME/server/lib/weblogic.jar.

Global and application-level configuration is described in the following sections.
5.6.1 Configuring Global Server-Level Data Binding and JAXB Providers

The following jar file is provided in the WebLogic Server distribution to simplify the task of overriding the default data binding configuration:

modules/databinding.override.jar

This jar file is not included in the classpath by default. To restore the Glassfish RI data binding and JAXB provider settings, edit the WebLogic Server start script to prepend this jar file to the classpath.

For the tooling and client, you can apply this jar file globally to Ant scripts or to another build environment.

Note that the modules/databinding.override.jar file overrides both the data binding provider and the JAXB provider. If you desire to override one of these providers, but not both, you can do so by creating a simple jar file containing only the service provider entry that you want to override, and putting this first in the classpath.

For example, to configure only the Glassfish RI JAXB provider:

1. Create a file named `META-INF/services/javax.xml.bind.JAXBContext` that contains a single entry for the Glassfish RI JAXB provider:
   
   com.sun.xml.bind.v2.ContextFactory

2. Create a jar file, for example `jaxb_override.jar`, and add the file created in Step 1.

3. Prepend this jar file to the classpath to use the Glassfish JAXB provider.

The same procedure applies if you want to configure only the Glassfish RI data binding provider. In this case, however, name the file you create in Step 1 `META-INF/services/com.sun.xml.ws.spi.db.BindingContextFactory` containing a single entry for the Glassfish RI data binding provider:

com.sun.xml.ws.db.glassfish.JAXBRIContextFactory.

As an alternative to placing the override jar file in the classpath, you can edit the Java system properties directly. For more information, see “Configuring Java System Properties for JAXB” on page 5-26.

5.6.2 Configuring Application-Level Data Binding and JAXB Providers

To configure the data binding and JAXB providers for a single Web application, you can use the filtering loading mechanism provided by WebLogic Server. This mechanism allows the system classpath search to be bypassed when looking for specific application classes and resources that are on the application classpath. Specifically, you use the `<prefer-application-resources>` tag in the `weblogic-application.xml` file for the application EAR or build-out directory.

For example, to configure the Glassfish RI data binding provider for an application:

1. Edit the `weblogic-application.xml` file to include an entry for the data binding resource, as shown in the following example:
2. Create a file named 
META-INF/services/com.sun.xml.ws.spi.db.BindingContextFactory containing an entry for the desired provider, in this case, 
com.sun.xml.ws.db.glassfish.JAXBRIContextFactory.

3. Add the file created in step 2 to the build-out directory, or add it as an entry in the EAR file.

Use the same procedure to configure the Glassfish RI JAXB provider using the values appropriate for the JAXB provider. Specifically, add the resource name META-INF/services/javax.xml.bind.JAXBContext to the weblogic-application.xml file and set the provider name in the file to com.sun.xml.bind.v2.ContextFactory.

For more information about the filtering loading mechanism in WebLogic Server, see "Filtering Loader Mechanism" in Tuning Performance of Oracle WebLogic Server.

### 5.6.3 Configuring Java System Properties for JAXB

You can configure the Java system properties to revert to the Glassfish RI providers and to configure the default EclipseLink MOXy providers if you had previously reverted.

**Note:** In certain situations, it can be difficult to propagate the system properties to an indirectly invoked Java instance, such as a client forked from an Ant task. In these situations, it is important to ensure that the environment you are using propagates the properties.

To configure the Glassfish RI data binding and JAXB providers, set the Java system properties as shown in Table 5–15.

<table>
<thead>
<tr>
<th>Set this Java system property . . .</th>
<th>To this value . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>javax.xml.bind.JAXBContext</td>
<td>com.sun.xml.bind.v2.ContextFactory</td>
</tr>
</tbody>
</table>

To configure the default EclipseLink MOXy providers, set the Java system properties as shown in Table 5–16.

<table>
<thead>
<tr>
<th>Set this Java system property . . .</th>
<th>To this value . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>javax.xml.bind.JAXBContext</td>
<td>org.eclipse.persistence.jaxb.JAXBContextFactory</td>
</tr>
</tbody>
</table>
This chapter provides some common examples of developing WebLogic web services using Java API for XML-based Web services (JAX-WS).

This chapter includes the following sections:

- Section 6.1, "Creating a Simple HelloWorld Web Service"
- Section 6.2, "Creating a Web Service With User-Defined Data Types"
- Section 6.3, "Creating a Web Service from a WSDL File"

Each example provides step-by-step procedures for creating simple WebLogic web services and invoking an operation from a deployed web service. The examples include basic Java code and Ant build.xml files that you can use in your own development environment to recreate the example, or by following the instructions to create and run the examples in an environment that is separate from your development environment.

The examples do not go into detail about the processes and tools used in the examples; later chapters are referenced for more detail.

---

**Note:** For best practice examples demonstrating advanced web service features, see Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients" and Chapter 13, "Roadmap for Developing Reliable Web Services and Clients."

---

### 6.1 Creating a Simple HelloWorld Web Service

This section describes how to create a very simple web service that contains a single operation. The *Java Web Service* (JWS) file that implements the web service uses just the one required *JWS annotation*: `@WebService`. A JWS file is a standard Java file that uses JWS metadata annotations to specify the shape of the web service. Metadata annotations were introduced with JDK 5.0, and the set of annotations used to annotate web service files are called JWS annotations. WebLogic web services use standard JWS annotations. For a complete list of JWS annotations that are supported, see "Web Service Annotation Support" in *WebLogic Web Services Reference for Oracle WebLogic Server*.

The following example shows how to create a web service called `HelloWorldService` that includes a single operation, `sayHelloWorld`. For simplicity, the operation returns the inputted String value.

1. Set your WebLogic Server environment.
Open a command window and execute the `setDomainEnv.cmd` (Windows) or `setDomainEnv.sh` (UNIX) script, located in the `bin` subdirectory of your domain directory. The default location of WebLogic Server domains is `ORACLE_HOME/user_projects/domains/domainName`, where `ORACLE_HOME` is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and `domainName` is the name of your domain.

2. Create a project directory, as follows:

   ```
   prompt> mkdir /myExamples/hello_world
   ```

3. Create a `src` directory under the project directory, as well as subdirectories that correspond to the package name of the JWS file (shown later in this procedure):

   ```
   prompt> cd /myExamples/hello_world
   prompt> mkdir src/examples/webservices/hello_world
   ```

4. Create the JWS file that implements the web service.

   Open your favorite Java IDE or text editor and create a Java file called `HelloWorldImpl.java` using the Java code specified in Section 6.1.1, "Sample HelloWorldImpl.java JWS File."

   The sample JWS file shows a Java class called `HelloWorldImpl` that contains a single public method, `sayHelloWorld(String)`. The `@WebService` annotation specifies that the Java class implements a web service called `HelloWorldService`. By default, all public methods are exposed as operations.

5. Save the `HelloWorldImpl.java` file in the `src/examples/webservices/hello_world` directory.

6. Create a standard Ant `build.xml` file in the project directory (`myExamples/hello_world/src`) and add a `taskdef` Ant task to specify the full Java classname of the `jwsc` task:

   ```
   <project name="webservices-hello_world" default='all'>
     <taskdef name="jwsc" classname="weblogic.wsee.tools.anttasks.JwscTask" />
   </project>
   ```

   See Section 6.1.2, "Sample Ant Build File for HelloWorldImpl.java" for a full sample `build.xml` file that contains additional targets from those described in this procedure, such as `clean`, `undeploy`, `client`, and `run`. The full `build.xml` file also uses properties, such as `$(ear-dir)`, rather than always using the hard-coded name for the EAR directory.

7. Add the following call to the `jwsc` task to the `build.xml` file, wrapped inside of the `build-service` target:

   ```
   <target name="build-service">
     <jwsc
       srcdir="src"
       destdir="output/helloWorldEar">
       <jws file="examples/webservices/hello_world/HelloWorldImpl.java"
            type="JAXWS"/>
     </jwsc>
   </target>
   ```

   The `jwsc` WebLogic web service Ant task generates the supporting artifacts, compiles the user-created and generated Java code, and archives all the artifacts into an Enterprise Application EAR file that you later deploy to WebLogic Server. You specify the type of web service (JAX-WS) that you want to create using `type="JAXWS"`. 

---

6-2 Developing JAX-WS Web Services for Oracle WebLogic Server
8. Execute the `jwsc` Ant task by specifying the `build-service` target at the command line:

```
prompt> ant build-service
```

See the `output/helloWorldEar` directory to view the files and artifacts generated by the `jwsc` Ant task.

9. Start the WebLogic Server instance to which the web service will be deployed.

10. Deploy the web service, packaged in an Enterprise Application, to WebLogic Server, using either the WebLogic Server Administration Console or the `wldeploy` Ant task. In either case, you deploy the `helloWorldEar` Enterprise application, located in the `output` directory.

   To use the `wldeploy` Ant task, add the following target to the `build.xml` file:

   ```xml
   <taskdef name="wldeploy"
            classname="weblogic.ant.taskdefs.management.WLDeploy"/>
   <target name="deploy">
     <wldeploy action="deploy"
               name="helloWorldEar" source="output/helloWorldEar"
               user="$\{wls.username\}" password="$\{wls.password\}"*
               verbose="true"
               adminurl="t3://$\{wls.hostname\}:$\{wls.port\}"
               targets="$\{wls.server.name\}" />
   </target>
   
   Substitute the values for `wls.username`, `wls.password`, `wls.hostname`, `wls.port`, and `wls.server.name` that correspond to your WebLogic Server instance.
   
   Deploy the WAR file by executing the `deploy` target:

```
prompt> ant deploy
```

11. Test that the web service is deployed correctly by invoking its WSDL in your browser:

```
http://host:port/HelloWorldImpl/HelloWorldService?WSDL
```

You construct the URL using the default values for the `contextPath` and `serviceUri` attributes. The default value for the `contextPath` is the name of the Java class in the JWS file. The default value of the `serviceURI` attribute is the `serviceName` element of the `@WebService` annotation if specified. Otherwise, the name of the JWS file, without its extension, followed by `Service`. For example, if the `serviceName` element of the `@WebService` annotation is not specified and the name of the JWS file is `HelloWorldImpl.java`, then the default value of its `serviceUri` is `HelloWorldImplService`.

   These attributes will be set explicitly in the next example, Section 6.2, "Creating a Web Service With User-Defined Data Types." Use the hostname and port relevant to your WebLogic Server instance.

   You can use the `clean`, `build-service`, `undeploy`, and `deploy` targets in the `build.xml` file to iteratively update, rebuild, undeploy, and redeploy the web service as part of your development process.

   To run the web service, you need to create a client that invokes it. See Section 9.2, "Invoking a Web Service from a WebLogic Web Service" for an example of creating a Java client application that invokes a web service.
6.1.1 Sample HelloWorldImpl.java JWS File

```java
package examples.webservices.hello_world;
// Import the @WebService annotation
import javax.jws.WebService;

@WebService(name="HelloWorldPortType", serviceName="HelloWorldService")
/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHelloWorld
 */
public class HelloWorldImpl {
    // By default, all public methods are exposed as Web Services operation
    public String sayHelloWorld(String message) {
        try {
            System.out.println("sayHelloWorld:" + message);
        } catch (Exception ex) { ex.printStackTrace(); }
        return "Here is the message: '" + message + "'";
    }
}
```

6.1.2 Sample Ant Build File for HelloWorldImpl.java

The following build.xml file uses properties to simplify the file.

```xml
<project name="webservices-hello_world" default="all">
    <!-- set global properties for this build -->
    <property name="wls.username" value="weblogic" />
    <property name="wls.password" value="weblogic" />
    <property name="wls.hostname" value="localhost" />
    <property name="wls.port" value="7001" />
    <property name="wls.server.name" value="myserver" />
    <property name="ear.deployed.name" value="helloWorldEar" />
    <property name="example-output" value="output" />
    <property name="ear-dir" value="${example-output}/helloWorldEar" />
    <property name="clientclass-dir" value="${example-output}/clientclasses" />
    <path id="client.class.path">
        <pathelement path="${clientclass-dir}"/>
        <pathelement path="${java.class.path}"/>
    </path>
    <taskdef name="jwsc"
        classname="weblogic.wsee.tools.anttasks.JwscTask" />
    <taskdef name="clientgen"
        classname="weblogic.wsee.tools.anttasks.ClientGenTask" />
    <taskdef name="wldeploy"
        classname="weblogic.ant.taskdefs.management.WLDeploy"/>
    <target name="all" depends="clean,build-service,deploy,client" />
    <target name="clean" depends="undeploy">
        <delete dir="${example-output}"/>
    </target>
    <target name="build-service">
        <jwsc
            srcdir="src"
            destdir="${(ear-dir)}"/>
        <jws file="examples/webservices/hello_world/HelloWorldImpl.java"
            type="JAXWS"/>
    </target>
    <target name="deploy">
        <wldeploy action="deploy" name="${ear.deployed.name}"/>
    </target>
</project>
```
6.2 Creating a Web Service With User-Defined Data Types

The preceding example uses only a simple data type, String, as the parameter and return value of the web service operation. This next example shows how to create a web service that uses a user-defined data type, in particular a JavaBean called BasicStruct, as both a parameter and a return value of its operation.

There is actually very little a programmer has to do to use a user-defined data type in a web service, other than to create the Java source of the data type and use it correctly in the JWS file. The jwsc Ant task, when it encounters a user-defined data type in the JWS file, automatically generates all the data binding artifacts needed to convert data between its XML representation (used in the SOAP messages) and its Java representation (used in WebLogic Server). The data binding artifacts include the XML Schema equivalent of the Java user-defined type.

The following procedure is very similar to the procedure in Section 6.1, "Creating a Simple HelloWorld Web Service." For this reason, although the procedure does show all the needed steps, it provides details only for those steps that differ from the simple HelloWorld example.

1. Set your WebLogic Server environment.

   Open a command window and execute the setDomainEnv.cmd (Windows) or setDomainEnv.sh (UNIX) script, located in the bin subdirectory of your domain
directory. The default location of WebLogic Server domains is $ORACLE_HOME/user_projects/domains/domainName$, where $ORACLE_HOME$ is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and $domainName$ is the name of your domain.

2. Create a project directory:
   
   prompt> mkdir /myExamples/complex
   
3. Create a src directory under the project directory, as well as subdirectories that correspond to the package name of the JWS file (shown later in this procedure):
   
   prompt> cd /myExamples/complex
   prompt> mkdir src/examples/webservices/complex
   
4. Create the source for the BasicStruct JavaBean.
   
   Open your favorite Java IDE or text editor and create a Java file called BasicStruct.java, in the project directory, using the Java code specified in Section 6.2.1, "Sample BasicStruct JavaBean."

5. Save the BasicStruct.java file in the src/examples/webservices/complex subdirectory of the project directory.

6. Create the JWS file that implements the web service using the Java code specified in Section 6.2.2, "Sample ComplexImpl.java JWS File."
   
   The sample JWS file uses several JWS annotations: @WebMethod to specify explicitly that a method should be exposed as a web service operation and to change its operation name from the default method name echoStruct to echoComplexType; @WebParam and @WebResponse to configure the parameters and return values; and @SOAPBinding to specify the type of web service. The ComplexImpl.java JWS file also imports the examples.webservice.complex.BasicStruct class and then uses the BasicStruct user-defined data type as both a parameter and return value of the echoStruct() method.

   For more in-depth information about creating a JWS file, see Chapter 4, "Programming the JWS File."

7. Save the ComplexImpl.java file in the src/examples/webservices/complex subdirectory of the project directory.

8. Create a standard Ant build.xml file in the project directory and add a taskdef Ant task to specify the fully Java classname of the jwsc task:
   
   <project name="webservices-complex" default="all">
     <taskdef name="jwsc" classname="weblogic.wsee.tools.anttasks.JwscTask" />
   </project>
   
   See Section 6.2.3, "Sample Ant Build File for ComplexImpl.java JWS File" for a full sample build.xml file.

9. Add the following call to the jwsc Ant task to the build.xml file, wrapped inside of the build-service target:
   
   <target name="build-service">
     <jwsc
       srcdir="src"
       destdir="output/ComplexServiceEar" >
       <jws file="examples/webservices/complex/ComplexImpl.java">
         type="JAXWS">
         <WLHttpTransport
In the preceding example:

- The `type` attribute of the `<jws>` element specifies the type of web service (JAX-WS or JAX-RPC).
- The `<WLHttpTransport>` child element of the `<jws>` element of the `jwsc` Ant task specifies the context path and service URI sections of the URL used to invoke the web service over the HTTP/S transport, as well as the name of the port in the generated WSDL. For more information about defining the context path, see "Defining the Context Path of a WebLogic Web Service" on page 3-17.

10. Execute the `jwsc` Ant task:

```
prompt> ant build-service
```

See the `output/ComplexServiceEar` directory to view the files and artifacts generated by the `jwsc` Ant task.

11. Start the WebLogic Server instance to which the web service will be deployed.

12. Deploy the web service, packaged in the `ComplexServiceEar` Enterprise Application, to WebLogic Server, using either the WebLogic Server Administration Console or the `wldeploy` Ant task. For example:

```
prompt> ant deploy
```

13. Deploy the web service, packaged in an Enterprise Application, to WebLogic Server, using either the WebLogic Server Administration Console or the `wldeploy` Ant task. In either case, you deploy the `ComplexServiceEar` Enterprise application, located in the `output` directory.

To use the `wldeploy` Ant task, add the following target to the `build.xml` file:

```
<target name="deploy">
  <wldeploy action="deploy" name="ComplexServiceEar" source="output/ComplexServiceEar" user="${wls.username}" password="${wls.password}" verbose="true" adminurl="t3://${wls.hostname}:${wls.port}" targets="${wls.server.name}" />
</target>
```

Substitute the values for `wls.username`, `wls.password`, `wls.hostname`, `wls.port`, and `wls.server.name` that correspond to your WebLogic Server instance.

Deploy the WAR file by executing the `deploy` target:

```
prompt> ant deploy
```

14. Test that the web service is deployed correctly by invoking its WSDL in your browser:

```
http://host:port/complex/ComplexService?WSDL
```
To run the web service, you need to create a client that invokes it. See Section 9.2, "Invoking a Web Service from a WebLogic Web Service" for an example of creating a Java client application that invokes a web service.

6.2.1 Sample BasicStruct JavaBean

```java
package examples.webservices.complex;
/**
 * Defines a simple JavaBean called BasicStruct that has integer, String,
 * and String[] properties
 */
public class BasicStruct {
    // Properties
    private int intValue;
    private String stringValue;
    private String[] stringArray;
    // Getter and setter methods
    public int getIntValue() {
        return intValue;
    }
    public void setIntValue(int intValue) {
        this.intValue = intValue;
    }
    public String getStringValue() {
        return stringValue;
    }
    public void setStringValue(String stringValue) {
        this.stringValue = stringValue;
    }
    public String[] getStringArray() {
        return stringArray;
    }
    public void setStringArray(String[] stringArray) {
        this.stringArray = stringArray;
    }
    public String toString() {
        return "IntValue=", intValue, "StringValue=" + stringValue;
    }
}
```

6.2.2 Sample ComplexImpl.java JWS File

```java
package examples.webservices.complex;
// Import the standard JWS annotation interfaces
import javax.jws.WebMethod;
import javax.jws.WebParam;
import javax.jws.WebResult;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
// Import the BasicStruct JavaBean
import examples.webservices.complex.BasicStruct;
// Standard JWS annotation that specifies that the portType name of the Web
// Service is "ComplexPortType", its public service name is "ComplexService",
// and the targetNamespace used in the generated WSDL is "http://example.org"
@WebService(serviceName="ComplexService", name="ComplexPortType",
            targetNamespace="http://example.org")
// Standard JWS annotation that specifies this is a document-literal-wrapped
// Web Service
@SOAPBinding(style=SOAPBinding.Style.DOCUMENT,
```

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/**
 * This JWS file forms the basis of a WebLogic Web Service. The Web Services
 * have two public operations:
 * - echoInt(int)
 * - echoComplexType(BasicStruct)
 *
 * The Web Service is defined as a "document-literal" service, which means
 * that the SOAP messages have a single part referencing an XML Schema element
 * that defines the entire body.
 */

public class ComplexImpl {
    // Standard JWS annotation that specifies that the method should be exposed
    // as a public operation. Because the annotation does not include the
    // member-value "operationName", the public name of the operation is the
    // same as the method name: echoInt.
    //
    // The WebResult annotation specifies that the name of the result of the
    // operation in the generated WSDL is "IntegerOutput", rather than the
    // default name 'return'. The WebParam annotation specifies that the input
    // parameter name in the WSDL file is "IntegerInput" rather than the Java
    // name of the parameter, "input".
    @WebMethod()
    @WebResult(name="IntegerOutput",
                targetNamespace="http://example.org/complex")
    public int echoInt(
                        @WebParam(name="IntegerInput",
                                   targetNamespace="http://example.org/complex")
                        int input)
    {
        System.out.println("echoInt "+ input + " to you too!");
        return input;
    }

    // Standard JWS annotation to expose method "echoStruct" as a public operation
    // called "echoComplexType"
    // The WebResult annotation specifies that the name of the result of the
    // operation in the generated WSDL is "EchoStructReturnMessage",
    // rather than the default name 'return'.
    @WebMethod(operationName="echoComplexType")
    @WebResult(name="EchoStructReturnMessage",
                targetNamespace="http://example.org/complex")
    public BasicStruct echoStruct(BasicStruct struct)
    {
        System.out.println("echoComplexType called");
        return struct;
    }
}

6.2.3 Sample Ant Build File for ComplexImpl.java JWS File

The following build.xml file uses properties to simplify the file.

```xml
<project name="webservices-complex" default="all">
    <!-- set global properties for this build -->
    <property name="wls.username" value="weblogic" />
    <property name="wls.password" value="weblogic" />
    <property name="wls.hostname" value="localhost" />
```
6.3 Creating a Web Service from a WSDL File

Another common example of creating a web service is to start from an existing WSDL file, often referred to as the golden WSDL. A WSDL file is a public contract that specifies what the web service looks like, such as the list of supported operations, the signature and shape of each operation, the protocols and transports that can be used when invoking the operations, and the XML Schema data types that are used when transporting the data. Based on this WSDL file, you generate the artifacts that implement the web service so that it can be deployed to WebLogic Server. You use the wsdlc Ant task to generate the following artifacts.

- JWS service endpoint interface (SEI) that implements the web service described by the WSDL file.
- JWS implementation file that contains a partial (stubbed-out) implementation of the generated JWS SEI. This file must be customized by the developer.
- JAXB data binding artifacts.
- Optional Javadocs for the generated JWS SEI.

Note: The only file generated by the wsdlc Ant task that you update is the JWS implementation file. You never need to update the JAR file that contains the JWS SEI and data binding artifacts.

Typically, you run the wsdlc Ant task one time to generate a JAR file that contains the generated JWS SEI file and data binding artifacts, then code the generated JWS file that implements the interface, adding the business logic of your web service. In particular, you add Java code to the methods that implement the web service operations so that the operations behave as needed and add additional JWS annotations.

After you have coded the JWS implementation file, you run the jwsc Ant task to generate the deployable web service, using the same steps as described in the preceding sections. The only difference is that you use the compiledWsdl attribute to specify the JAR file (containing the JWS SEI file and data binding artifacts) generated by the wsdlc Ant task.

The following simple example shows how to create a web service from the WSDL file shown in Section 6.3.1, "Sample WSDL File." The web service has one operation, getTemp, that returns a temperature when passed a zip code.

1. Set your WebLogic Server environment.

   Open a command window and execute the setDomainEnv.cmd (Windows) or setDomainEnv.sh (UNIX) script, located in the bin subdirectory of your domain.
directory. The default location of WebLogic Server domains is ORACLE_HOME/user_projects/domains/domainName, where ORACLE_HOME is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and domainName is the name of your domain.

2. Create a working directory:

```
prompt> mkdir /myExamples/wsdlc
```

3. Put your WSDL file into an accessible directory on your computer.

For the purposes of this example, it is assumed that your WSDL file is called TemperatureService.wsdl and is located in the /myExamples/wsdlc/wsdl_files directory. See Section 6.3.1, “Sample WSDL File” for a full listing of the file.

4. Create a standard Ant build.xml file in the project directory and add a taskdef Ant task to specify the full Java classname of the wsdlc task:

```xml
<project name="webservices-wsdlc" default="all">
  <taskdef name="wsdlc" classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
</project>
```

See Section 6.3.3, "Sample Ant Build File for TemperatureService" for a full sample build.xml file that contains additional targets from those described in this procedure, such as clean, undeploy, client, and run. The full build.xml file also uses properties, such as ${ear-dir}, rather than always using the hard-coded name for the EAR directory.

5. Add the following call to the wsdlc Ant task to the build.xml file, wrapped inside of the generate-from-wsdl target:

```xml
<target name="generate-from-wsdl">
  <wsdlc srcWsdl="wsdl_files/TemperatureService.wsdl" destJwsDir="output/compiledWsdl" destImplDir="output/impl" packageName="examples.webservices.wsdlc" type="JAXWS"/>
</target>
```

The wsdlc task in the examples generates the JAR file that contains the JWS SEI and data binding artifacts into the output/compiledWsdl directory under the current directory. It also generates a partial implementation file (TemperatureService_TemperaturePortImpl.java) of the JWS SEI into the output/impl/examples/webservices/wsdlc directory (which is a combination of the output directory specified by destImplDir and the directory hierarchy specified by the package name). All generated JWS files will be packaged in the examples.webservices.wsdlc package.

6. Execute the wsdlc Ant task by specifying the generate-from-wsdl target at the command line:

```
prompt> ant generate-from-wsdl
```

See the output directory if you want to examine the artifacts and files generated by the wsdlc Ant task.

7. Update the generated

```
output/impl/examples/webservices/wsdlc/TemperatureService_TemperaturePortImpl.java
```
JWS implementation file using your favorite Java IDE or text editor to add Java code to the methods so that they behave as you want.
See Section 6.3.2, "Sample TemperatureService_TemperaturePortImpl Java Implementation File" for an example; the added Java code is in **bold**. The generated JWS implementation file automatically includes values for the @WebService JWS annotation that corresponds to the value in the original WSDL file.

**Note:** There are restrictions on the JWS annotations that you can add to the JWS implementation file in the "starting from WSDL" use case. See "wsdlc" in the WebLogic Web Services Reference for Oracle WebLogic Server for details.

For simplicity, the sample `getTemp()` method in `TemperatureService_TemperaturePortImpl.java` returns a hard-coded number. In real life, the implementation of this method would actually look up the current temperature at the given zip code.

8. Copy the updated `TemperatureService_TemperaturePortImpl.java` file into a permanent directory, such as a `src` directory under the project directory; remember to create child directories that correspond to the package name:

```
prompt> cd /examples/wsdlc
prompt> mkdir src/examples/webservices/wsdlc
prompt> cp output/impl/examples/webservices/wsdlc/TemperatureService_TemperaturePortImpl.java.java src/examples/webservices/wsdlc/TemperatureService_TemperaturePortImpl.java.java
```

9. Add a build-service target to the `build.xml` file that executes the `jwsc` Ant task against the updated JWS implementation class. Use the `compiledWsdl` attribute of `jwsc` to specify the name of the JAR file generated by the `wsdlc` Ant task:

```
<taskdef name="jwsc" class="weblogic.wsee.tools.anttasks.JwscTask" />
<target name="build-service">
  <jwsc srcdir="src" destdir="${ear-dir}"
  <jws file="examples/webservices/wsdlc/TemperatureService_TemperaturePortImpl.java"
    compiledWsdl="${compiledWsdl-dir}/TemperatureService_wsdl.jar"
    type="JAXWS">
    <WLHttpTransport contextPath="temp" serviceUri="TemperatureService" portName="TemperaturePort">
    </WLHttpTransport>
  </jws>
</jwsc>
</target>
```

In the preceding example:

- The `type` attribute of the `<jws>` element specifies the type of web services (JAX-WS or JAX-RPC).
- The `<WLHttpTransport>` child element of the `<jws>` element of the `jwsc` Ant task specifies the context path and service URI sections of the URL used to invoke the web service over the HTTP/S transport, as well as the name of the port in the generated WSDL.
10. Execute the build-service target to generate a deployable web service:

```
prompt> ant build-service
```

You can re-run this target if you want to update and then re-build the JWS file.

11. Start the WebLogic Server instance to which the web service will be deployed.

12. Deploy the web service, packaged in an Enterprise Application, to WebLogic Server, using either the WebLogic Server Administration Console or the `wldeploy` Ant task. In either case, you deploy the `wsdlcEar` Enterprise application, located in the output directory.

To use the `wldeploy` Ant task, add the following target to the `build.xml` file:

```xml
<taskdef name="wldeploy" class="weblogic.ant.taskdefs.management.WLDeploy"/>
<target name="deploy">
  <wldeploy action="deploy" name="wsdlcEar"
    source="output/wsdlcEar" user="${wls.username}" password="${wls.password}" verbose="true"
    adminurl="t3://${wls.hostname}:${wls.port}"
    targets="${wls.server.name}"/>
</target>
```

Substitute the values for `wls.username`, `wls.password`, `wls.hostname`, `wls.port`, and `wls.server.name` that correspond to your WebLogic Server instance.

Deploy the WAR file by executing the `deploy` target:

```
prompt> ant deploy
```

13. Test that the web service is deployed correctly by invoking its WSDL in your browser:

```text
http://host:port/temp/TemperatureService?WSDL
```

The context path and service URI section of the preceding URL are specified by the original golden WSDL. Use the hostname and port relevant to your WebLogic Server instance. Note that the deployed and original WSDL files are the same, except for the host and port of the endpoint address.

You can use the clean, build-service, undeploy, and deploy targets in the `build.xml` file to iteratively update, rebuild, undeploy, and redeploy the web service as part of your development process.

To run the web service, you need to create a client that invokes it. See Section 9.2, "Invoking a Web Service from a WebLogic Web Service" for an example of creating a Java client application that invokes a web service.

### 6.3.1 Sample WSDL File

```xml
<?xml version="1.0"?>
  <types>
    <xsd:schema
```
Creating a Web Service from a WSDL File

Examples of Developing JAX-WS Web Services

6.3.2 Sample TemperatureService_TemperaturePortImpl Java Implementation File

```java
package examples.webservices.wsdlc;
import javax.jws.WebService;
import javax.xml.ws.BindingType;

targetNamespace="http://www.xmethods.net/sd/TemperatureService.wsdl"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
<xsd:element name="getTempRequest">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="zip" type="xsd:string"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
<xsd:element name="getTempResponse">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="return" type="xsd:float"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
</xsd:schema>
</types>
<message name="getTempRequest">
  <part name="parameters" element="tns:getTempRequest"/>
</message>
<message name="getTempResponse">
  <part name="parameters" element="tns:getTempResponse"/>
</message>
<portType name="TemperaturePortType">
  <operation name="getTemp">
    <input message="tns:getTempRequest"/>
    <output message="tns:getTempResponse"/>
  </operation>
</portType>
<binding name="TemperatureBinding" type="tns:TemperaturePortType">
  <soap:binding style="document"
    transport="http://schemas.xmlsoap.org/soap/http"/>
  <operation name="getTemp">
    <input>
      <soap:body use="literal"/>
    </input>
    <output>
      <soap:body use="literal"/>
    </output>
  </operation>
</binding>
<service name="TemperatureService">
  <documentation>
    Returns current temperature in a given U.S. zipcode
  </documentation>
  <port name="TemperaturePort" binding="tns:TemperatureBinding">
    <soap:address
      location="http://localhost:7001/temp/TemperatureService"/>
  </port>
</service>
</definitions>
```

6.3.2 Sample TemperatureService_TemperaturePortImpl Java Implementation File

```java
package examples.webservices.wsdlc;
import javax.jws.WebService;
import javax.xml.ws.BindingType;
```
/**
 * Returns current temperature in a given U.S. zipcode
 * This class was generated by the JAX-WS RI.
 * JAX-WS RI 2.2.8-b13684
 * Generated source version: 2.2
 */

@WebService(
    portName = "TemperaturePort",
    serviceName = "TemperatureService",
    targetNamespace="http://www.xmethods.net/sd/TemperatureService.wsdl"
    wsdlLocation = "/wsdls/TemperatureService.wsdl",
    endpointInterface = "examples.webservices.wsdlc.TemperaturePortType")

@BindingType("http://schemas.xmlsoap.org/wsdl/soap/http")
public class TemperatureService_TemperaturePortImpl implements TemperaturePortType{
    public TemperatureService_TemperaturePortImpl() {
    }

    /**
     * @param zip
     * @return
     *     returns float
     */
    public float getTemp(String zip) {
        return 1.234f;
    }
}

6.3.3 Sample Ant Build File for TemperatureService

The following build.xml file uses properties to simplify the file.

<project default="all">
    <!-- set global properties for this build -->
    <property name="wls.username" value="weblogic" />
    <property name="wls.password" value="weblogic" />
    <property name="wls.hostname" value="localhost" />
    <property name="wls.port" value="7001" />
    <property name="wls.server.name" value="myserver" />
    <property name="ear.deployed.name" value="wsdlcEar" />
    <property name="example-output" value="output" />
    <property name="compiledWsdl-dir" value="${example-output}/compiledWsdl" />
    <property name="impl-dir" value="${example-output}/impl" />
    <property name="ear-dir" value="${example-output}/wsdlcEar" />
    <property name="clientclass-dir" value="${example-output}/clientclasses" />
    <path id="client.class.path">
        <pathelement path="${clientclass-dir}"/>
        <pathelement path="${java.class.path}"/>
    </path>
    <taskdef name="wsdlc"
        classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
    <taskdef name="jwsc"
        classname="weblogic.wsee.tools.anttasks.JwscTask"/>
    <taskdef name="clientgen"
        classname="weblogic.wsee.tools.anttasks.ClientGenTask"/>
    <taskdef name="wldeploy"
        classname="weblogic.ant.taskdefs.management.WLDeploy"/>
<target name="all">
  depends="clean, generate-from-wsdl, build-service, deploy, client" />
<target name="clean" depends="undeploy">
  <delete dir="${example-output}" />
</target>
<target name="generate-from-wsdl">
  <wsdlc
    srcWsdl="wsdl_files/TemperatureService.wsdl"
    destJwsDir="${compiledWsdl-dir}"
    destImplDir="${impl-dir}"
    packageName="examples.webservices.wsdlc"
    type="JAXWS" />
</target>
<target name="build-service">
  <jwsc
    srcdir="src"
    destdir="${ear-dir}" >>
  <jws
    file="examples/webservices/wsdlc/TemperatureService_TemperaturePortImpl.java"
    compiledWsdl="${compiledWsdl-dir}/TemperatureService_wsdl.jar"
    type="JAXWS">
    <WLHttpTransport
      contextPath="temp" serviceUri="TemperatureService"
      portName="TemperaturePort" />
</jws>
</jwsc>
</target>
<target name="deploy">
  <wldeploy action="deploy" name="${ear.deployed.name}"
    source="${ear-dir}" user="${wls.username}" password="${wls.password}" verbose="true"
    adminurl="t3://${wls.hostname}:${wls.port}"
    targets="${wls.server.name}" />
</target>
<target name="undeploy">
  <wldeploy action="undeploy" name="${ear.deployed.name}"
    failonerror="false"
    user="${wls.username}" password="${wls.password}" verbose="true"
    adminurl="t3://${wls.hostname}:${wls.port}"
    targets="${wls.server.name}" />
</target>
<target name="client">
  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/temp/TemperatureService?WSDL"
    destDir="${clientclass-dir}"
    packageName="examples.webservices.wsdlc.client"
    type="JAXWS">
  <javac
    srcdir="${clientclass-dir}" destdir="${clientclass-dir}"
    includes="**/*.java" />
  <javac
    srcdir="src" destdir="${clientclass-dir}"
    includes="examples/webservices/wsdlc/client/**/*.java" />
</target>
<target name="run">
  <java
    classname="examples.webservices.wsdlc.client.TemperatureClient"
    fork="true" failonerror="true">
  <arg line="http://${wls.hostname}:${wls.port}/temp/TemperatureService" />
</java>
</target>
</target>
</java>
</target>
</project>
Part III describes how to develop basic WebLogic web service clients using Java API for XML-based web services (JAX-WS).

Sections include:

- Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients"
- Chapter 8, "Developing Web Service Clients"
- Chapter 9, "Examples of Developing JAX-WS Web Service Clients"
This chapter presents best practices for developing WebLogic web service clients for Java API for XML Web Services (JAX-WS).

Table 7–1 lists each best practice and is followed by an example that illustrates the best practices presented. The best practices are described in more detail later in this document.

For additional best practices, refer to the following sections:

- For best practices when developing asynchronous web service clients, see Chapter 11, “Roadmap for Developing Asynchronous Web Service Clients.”
- For best practices when developing reliable web service clients, see Chapter 13, ”Roadmap for Developing Reliable Web Services and Clients.”

---

**Note:** In the following table, *client instance* can be a port or a Dispatch instance.

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronize use of client instances.</td>
<td>Create client instances as you need them; do not store them long term.</td>
</tr>
</tbody>
</table>
Table 7–1  (Cont.) Roadmap for Developing Web Service Clients

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use a stored list of features, including client ID, to create client instances.</td>
<td>Define all features for the web service client instance, including client ID, so that they are consistent each time the client instance is created. For example: <code>_service.getBackendServicePort(_features);</code></td>
</tr>
</tbody>
</table>
| Explicitly define the client ID. | Use the `ClientIdentityFeature` to define the client ID explicitly. This client ID is used to group statistics and other monitoring information, and for reporting runtime validations, and so on. For more information, see Section 8.7, "Managing Client Identity."

**Note:** Oracle strongly recommends that you define the client ID explicitly. If not explicitly defined, the server generates the client ID automatically, which may not be user-friendly. |
| Explicitly close client instances when processing is complete. | For example: `((java.io.Closeable)port).close();`
| | If not closed explicitly, the client instance will be closed automatically when it goes out of scope.

**Note:** The client ID remains registered and visible until the container (Web application or EJB) is deactivated. For more information, see Section 8.7.3, "Client Identity Lifecycle." |

The following example illustrates best practices for developing web service clients.

**Example 7–1  Web Service Client Best Practices Example**

```java
import java.io.IOException;
import java.util.*;
import javax.servlet.*;
import javax.xml.ws.*;
import weblogic.jws.jaxws.client.ClientIdentityFeature;

/**
 * Example client for invoking a web service.
 */
public class BestPracticeClient extends GenericServlet {

private BackendServiceService _service;
private WebServiceFeature[] _features;
private ClientIdentityFeature _clientIdFeature;

@Override
public void init()
throws ServletException {

// Create a single instance of a web service as it is expensive to create repeatedly.
if (_service == null) {
    _service = new BackendServiceService();
}

// Best Practice: Use a stored list of features, per client ID, to create client instances.
// Define all features for the web service client instance, per client ID, so that they are consistent each time the client instance is created. For example:
// _service.getBackendServicePort(_features);
```
List<WebServiceFeature> features = new ArrayList<WebServiceFeature>();

// **Best Practice: Explicitly define the client ID.**
// TODO: Maybe allow ClientIdentityFeature to store other features, and
// then create new client instances simply by passing the
// ClientIdentityFeature (and the registered features are used).
// _clientIdFeature = new ClientIdentityFeature("MyBackendServiceClient");
features.add(_clientIdFeature);

// Set the features used when creating clients with
// the client ID "MyBackendServiceClient". The features are stored in an array to
// reinforce that the list should be treated as immutable.
// _features = features.toArray(new WebServiceFeature[features.size()]);
}

@Override
public void service(ServletRequest req, ServletResponse res)
    throws ServletException, IOException {

    // ... Read the servlet request ...

    // **Best Practice: Synchronize use of client instances.**
    // Create a web service client instance to talk to the backend service.
    // Note, at this point the client ID is 'registered' and becomes
    // visible to monitoring tools such as the Administration Console and WLST.
    // The client ID *remains* registered and visible until the container
    // (the Web application hosting our servlet) is deactivated (undeployed).
    //
    // A client ID can be used when creating multiple client instances (port or Dispatch client).
    // The client instance should be created with the same set of features each time, and should
    // use the same service class and refer to the same port type.
    // A given a client ID should be used for a given port type, but not across port types.
    // It can be used for both port and Dispatch clients.
    BackendService port =
        _service.getBackendServicePort(_features);

    // Set the endpoint address for BackendService.
    ((BindingProvider)port).getRequestContext().
        put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
            "http://localhost:7001/BestPracticeService/BackendService");

    // Print out the explicit client ID, and compare it to the client ID
    // that would have been generated automatically for the client instance.
    showClientIdentity();

    // Make the invocation on our real port
    String request = "Make a cake";
    System.out.println("Invoking DoSomething with request: " + request);
    String response = port.doSomething(request);
    System.out.println("Got response: " + response);
    res.getWriter().write(response);

    // **Best Practice: Explicitly close client instances when processing is complete.**
    // If not closed, the client instance will be closed automatically when it goes out of
    // scope. Note, this client ID will remain registered and visible until our
    // container (Web application) is undeployed.
    ((java.io.Closeable)port).close();
}

/**
private void showClientIdentity()
    throws IOException {
    System.out.println("Client Identity is: " + _clientIdFeature.getClientId());

    // Create a client instance without explicitly defining the client ID to view the
    // client ID that is generated automatically.
    ClientIdentityFeature dummyClientIdFeature =
        new ClientIdentityFeature(null);
    BackendService dummyPort =
        _service.getBackendServicePort(dummyClientIdFeature);
    System.out.println("Generated Client Identity is: " +
        dummyClientIdFeature.getClientId());

    // Best Practice: Explicitly close client instances when processing is complete.
    // If not closed, the client instance will be closed automatically when it goes out of
    // scope. Note, this client ID will remain registered and visible until our
    // container (Web application) is undeployed.
    ((java.io.Closeable)dummyPort).close();
}

@Override
public void destroy() {
}
Developing Web Service Clients

This chapter describes how to develop Java EE clients to invoke a WebLogic web service using Java API for XML-based Web Services (JAX-WS).

This chapter includes the following sections:

- Overview of WebLogic Web Services Client Development
- Invoking a Web Service from a Java SE Client
- Invoking a Web Service from a Standalone Java SE Client
- Invoking a Web Service from Another WebLogic Web Service
- Configuring Web Service Clients
- Defining a Web Service Reference Using the @WebServiceRef Annotation
- Managing Client Identity
- Using a Proxy Server When Invoking a Web Service
- Client Considerations When Redeploying a Web Service
- Client Considerations When Web Service and Client Are Deployed to the Same Managed Server

8.1 Overview of WebLogic Web Services Client Development

Invoking a web service refers to the actions that a client application performs to use the web service.

There are two types of client applications:

- Java SE client—In its simplest form, a Java SE client is a Java program that has the `Main` public class that you invoke with the `java` command. A Java SE client can be invoked within a WebLogic Server environment (with access to the WebLogic Server classpath) or as a standalone client application.

- Java EE component deployed to WebLogic Server—In this type of client application, the web service runs inside a Java Platform, Enterprise Edition (Java EE) Version 5 component deployed to WebLogic Server, such as an EJB, servlet, or another web service. This type of client application, therefore, runs inside a WebLogic Server container.

The sections that follow describe how to use Oracle's implementation of the JAX-WS specification to invoke a web service from a Java client application. You can use this implementation to invoke web services running on any application server, both WebLogic and non-WebLogic.
WebLogic Server optionally includes examples of creating and invoking WebLogic web services in the ORACLE_HOME/wlserver/samples/server/examples/src/examples directory, where ORACLE_HOME represents the directory in which you installed WebLogic Server. For detailed instructions on how to build and run the examples, open the ORACLE_HOME/wlserver/samples/server/docs/index.html Web page in your browser and expand the WebLogic Server Examples->Examples->API->Web Services node. For more information, see “Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.

For more information about:

- Invoking message-secured web services, see "Updating a Client Application to Invoke a Message-Secured Web Service" in Securing WebLogic Web Services for Oracle WebLogic Server.
- Best practices for developing web service clients, see Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients."
- Invoking web services asynchronously, see Chapter 12, "Developing Asynchronous Clients."
- Creating a dynamic proxy client, using the javax.xml.ws.Service API, that enables a web service client to invoke a web service based on a service endpoint interface (SEI) dynamically at run-time (without using clientgen), see Chapter 27, "Developing Dynamic Proxy Clients." This chapter focuses on how to generate a static Java class of the Service interface implementation for the particular web service you want to invoke.

8.2 Invoking a Web Service from a Java SE Client

The following table summarizes the main steps to create a Java SE application that invokes a web service.

---

**Note:** In this section, it is assumed that:

- When you invoke a web service using the client-side artifacts generated by the clientgen or wsdlc Ant tasks, you have the entire set of WebLogic Server classes in your CLASSPATH. Support for standalone Java applications that are running in an environment where WebLogic Server libraries is described in Section 8.3, "Invoking a Web Service from a Standalone Java SE Client."

- You use Ant in your development environment to build your client application, compile Java files, and so on, and that you have an existing build.xml file that you want to update with web services client tasks. For general information about using Ant in your development environment, see Section 3.5, "Creating the Basic Ant build.xml File." For a full example of a build.xml file used in this section, see Section 8.2.5, "Sample Ant Build File for a Java Client."

---
8.2.1 Using the clientgen Ant Task To Generate Client Artifacts

The clientgen WebLogic web services Ant task generates, from an existing WSDL file, the client artifacts that client applications use to invoke both WebLogic and non-WebLogic web services. These artifacts include:

- The Java class for the Service interface implementation for the particular web service you want to invoke.
- JAXB data binding artifacts.
- The Java class for any user-defined XML Schema data types included in the WSDL file.

For additional information about the clientgen Ant task, such as all the available attributes, see "Ant Task Reference" in the WebLogic Web Services Reference for Oracle WebLogic Server.

Update your build.xml file, adding a call to the clientgen Ant task, as shown in the following example:

```xml
<taskdef name="clientgen"
   classname="weblogic.wsee.tools.anttasks.ClientGenTask" />
<target name="build-client">
  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    destDir="clientclasses"
    packageName="examples.webservices.simple_client"
    type="JAXWS"/>
</target>
```

Before you can execute the clientgen WebLogic web service Ant task, you must specify its full Java classname using the standard taskdef Ant task.
You must include the `wsdl` and `destDir` attributes of the `clientgen` Ant task to specify the WSDL file from which you want to create client-side artifacts and the directory into which these artifacts should be generated. The `packageName` attribute is optional; if you do not specify it, the `clientgen` task uses a package name based on the `targetNamespace` of the WSDL. The `type` is required in this example; otherwise, it defaults to `JAXRPC`.

In this example, the package name is set to the same package name as the client application, `examples.webservices.simple_client`. If you set the package name to one that is different from the client application, you would need to import the appropriate class files. For example, if you defined the package name as `examples.webservices.complex`, you would need to import the following class files in the client application:

```java
import examples.webservices.complex.BasicStruct;
import examples.webservices.complex.ComplexPortType;
import examples.webservices.complex.ComplexService;
```

**Note:** The `clientgen` Ant task also provides the `destFile` attribute if you want the Ant task to automatically compile the generated Java code and package all artifacts into a JAR file. For details and an example, see “`clientgen`” in the WebLogic Web Services Reference for Oracle WebLogic Server.

If the WSDL file specifies that user-defined data types are used as input parameters or return values of web service operations, `clientgen` automatically generates a JavaBean class that is the Java representation of the XML Schema data type defined in the WSDL. The JavaBean classes are generated into the `destDir` directory.

For a full sample `build.xml` file that contains additional targets from those described in this procedure, such as `clean`, see Section 8.2.5, “Sample Ant Build File for a Java Client.”

To execute the `clientgen` Ant task, along with the other supporting Ant tasks, specify the `build-client` target at the command line:

```
prompt> ant build-client
```

See the `clientclasses` directory to view the files and artifacts generated by the `clientgen` Ant task.

### 8.2.2 Getting Information About a Web Service

You need to know the name of the web service and the signature of its operations before you write your Java client application code to invoke an operation. There are a variety of ways to find this information.

The best way to get this information is to use the `clientgen` Ant task to generate the web service-specific `Service` files and look at the generated `.java` files. These files are generated into the directory specified by the `destDir` attribute, with subdirectories corresponding to either the value of the `packageName` attribute, or, if this attribute is not specified, to a package based on the `targetNamespace` of the WSDL.

- The `ServiceName.java` source file contains the `getPortName()` methods for getting the web service port, where `ServiceName` refers to the name of the web service and `PortName` refers to the name of the port. If the web service was implemented with a JWS file, the name of the web service is the value of the `serviceName` attribute of
the @WebService JWS annotation and the name of the port is the value of the portName attribute of the <WLHttpTransport> child element of the <jws> element of the jwsc Ant task.

- The PortType.java file contains the method signatures that correspond to the public operations of the web service, where PortType refers to the port type of the web service. If the web service was implemented with a JWS file, the port type is the value of the name attribute of the @WebService JWS annotation.

You can also examine the actual WSDL of the web service; see Section 3.10, "Browsing to the WSDL of the Web Service" for details about the WSDL of a deployed WebLogic web service. The name of the web service is contained in the <service> element, as shown in the following excerpt of the TraderService WSDL:

```
<service name="TraderService">
  <port name="TraderServicePort"
       binding="tns:TraderServiceSoapBinding">
    ...
  </port>
</service>
```

The operations defined for this web service are listed under the corresponding <binding> element. For example, the following WSDL excerpt shows that the TraderService web service has two operations, buy and sell (for clarity, only relevant parts of the WSDL are shown):

```
<binding name="TraderServiceSoapBinding" ...>
  ...
  <operation name="sell">
    ...
  </operation>
  <operation name="buy">
    ...
  </operation>
</binding>
```

### 8.2.3 Writing the Java Client Application Code to Invoke a Web Service

In the following code example, a Java application invokes a web service operation. The application uses standard JAX-WS API code and the web service-specific implementation of the Service interface, generated by clientgen, to invoke an operation of the web service.

The example also shows how to invoke an operation that has a user-defined data type (examples.webservices.simple_client.BasicStruct) as an input parameter and return value. The clientgen Ant task automatically generates the Java code for this user-defined data type.

Because the <clientgen> packageName attribute was set to the same package name as the client application, we are not required to import the <clientgen>-generated files.

```
package examples.webservices.simple_client;
/**
 * This is a simple Java application that invokes the
 * the echoComplexType operation of the ComplexService web service.
 */
public class Main {
  public static void main(String[] args) {
    ComplexService test = new ComplexService();
    ComplexPortType port = test.getComplexPortTypePort();
    BasicStruct in = new BasicStruct();
```
In the preceding example:

- The following code shows how to create a ComplexPortType stub:

  ```java
  ComplexService test = new ComplexService();
  ComplexPortType port = test.getComplexPortTypePort();
  ``

  The ComplexService class implements the JAX-WS Service interface. The getComplexServicePortTypePort() method is used to return an instance of the ComplexPortType stub implementation.

- The following code shows how to invoke the echoComplexType operation of the ComplexService web service:

  ```java
  BasicStruct result = port.echoComplexType(in);
  ``

  The echoComplexType operation returns the user-defined data type called BasicStruct.

### 8.2.4 Compiling and Running the Client Application

Add `javac` tasks to the `build-client` target in the `build.xml` file to compile all the Java files (both of your client application and those generated by `clientgen`) into class files, as shown by the **bold** text in the following example:

```xml
<target name="build-client">
  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL" 
    destDir="clientclasses" 
    packageName="examples.webservices.simple_client" 
    type="JAXWS"/>
  <javac
    srcdir="clientclasses" 
    destdir="clientclasses" 
    includes="**/*.java"/>
  <javac
    srcdir="src" 
    destdir="clientclasses" 
    includes="examples/webservices/simple_client/*.java"/>
</target>
```

In the example, the first `javac` task compiles the Java files in the `clientclasses` directory that were generated by `clientgen`, and the second `javac` task compiles the Java files in the `examples/webservices/simple_client` subdirectory of the current directory; where it is assumed your Java client application source is located.

In the preceding example, the `clientgen`-generated Java source files and the resulting compiled classes end up in the same directory (`clientclasses`). Although this might be adequate for prototyping, it is often a best practice to keep source code (even generated code) in a different directory from the compiled classes. To do this, set the `destdir` for both `javac` tasks to a directory different from the `srcdir` directory. To run the client application, add a `run` target to the `build.xml` that includes a call to the `java` task, as shown below:
The path task adds the clientclasses directory to the CLASSPATH. The run target invokes the Main application, passing it the URL of the deployed web service as its single argument.

See Section 8.2.5, "Sample Ant Build File for a Java Client" for a full sample build.xml file that contains additional targets from those described in this procedure, such as clean.

Rerun the build-client target to regenerate the artifacts and recompile into classes, then execute the run target to invoke the echoStruct operation:

```
prompt> ant build-client run
```

You can use the build-client and run targets in the build.xml file to iteratively update, rebuild, and run the Java client application as part of your development process.

### 8.2.5 Sample Ant Build File for a Java Client

The following example shows a complete build.xml file for generating and compiling a Java client. See Section 8.2.1, "Using the clientgen Ant Task To Generate Client Artifacts" and Section 8.2.4, "Compiling and Running the Client Application" for explanations of the sections in bold.

```xml
<project name="webservices-simple_client" default="all">
  <!-- set global properties for this build -->
  <property name="wls.hostname" value="localhost" />
  <property name="wls.port" value="7001" />
  <property name="example-output" value="output" />
  <property name="clientclass-dir" value="${example-output}/clientclass" />
  <path id="client.class.path">
    <pathelement path="${clientclass-dir}"/>
    <pathelement path="${java.class.path}"/>
  </path>
  <taskdef name="clientgen"classname="weblogic.wsee.tools.anttasks.ClientGenTask"/>
  <target name="clean">
    <delete dir="${clientclass-dir}"/>
  </target>
  <target name="all" depends="clean,build-client,run" />
  <target name="build-client">
    <clientgen wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL" destDir="${clientclass-dir}" packageName="examples.webservices.simple_client" type="JAXWS"/>
    <javac srcdir="${clientclass-dir}" destdir="${clientclass-dir}"/>
  </target>
</project>
```
8.3 Invoking a Web Service from a Standalone Java SE Client

In Section 8.2, "Invoking a Web Service from a Java SE Client," it is assumed that when you invoke a Web Service using the client-side artifacts generated by the clientgen or wsdlc Ant tasks, you have the entire set of WebLogic Server classes in your classpath. If, however, you do not have WebLogic Server installed locally, you can still invoke a Web Service by using one of the standalone WebLogic web services client JAR files.

Table 8–2 summarizes the standalone web service client JAR files that are available in the installation.
To use a standalone web services client JAR file with your client application, perform the following steps:

1. Create a Java SE client using your favorite IDE, such as Oracle JDeveloper. For more information, see "Developing and Securing Web Services and Clients" in Developing Applications with Oracle JDeveloper.

2. Copy the required JAR files, defined in Table 8–2, from the computer hosting WebLogic Server to the appropriate directory on the standalone client computer. For example, you might copy the files into the directory that contains other classes used by your client application.

3. Add the JAR files to your CLASSPATH.

---

Table 8–2 Standalone Web Service Client JAR Files

<table>
<thead>
<tr>
<th>JAR File</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
</table>
| com.oracle.webservices.wls.jaxws-wlswws-client.jar | ORACLE_HOME/wlserver/modules/clients/ | Supports basic JAX-WS client-side functionality including:  
- Using client-side artifacts created by both the clientgen Ant tasks  
- Processing SOAP messages  
- Using advanced features, such as web services reliable messaging, WS addressing, asynchronous request-response, and MTOM  
- Using WS-Security  
- Using client-side SOAP message handlers  
- Invoking both JAX-WS and JAX-RPC web services  
- Using SSL  

The standalone client JAR does not support invoking web services that use the following advanced features:  
- SOAP over JMS transport  
- Conversations  
- Buffering |
| com.oracle.webservices.wls.jaxws-owsm-client.jar | ORACLE_HOME/oracle_common/modules/clients/ | Supports the same functionality as com.oracle.webservices.wls.jaxws-client.jar (above), plus support for Oracle Web Services Manager (OWSM) security policies, as described in Securing Web Services and Managing Policies with Oracle Web Services Manager. |
| com.oracle.webservices.fmw.client.jar | ORACLE_HOME/oracle_common/modules/clients/ | Provides support for WS-Secure Conversation security, as described in "Configuring Secure Conversation" in Securing Web Services and Managing Policies with Oracle Web Services Manager. |

---

Note: Ensure that your CLASSPATH includes the JAR file that contains the Ant classes (ant.jar) as a subset are used by the standalone client JAR files. This JAR file is typically located in the lib directory of the Ant distribution.
4. Configure your environment for Oracle Web Services Manager (OWSM) policies. This step is optional, required only if you are attaching OWSM security policies to the web service client.

The configuration steps required vary based on the type of policy being attached. Examples are provided below. For additional configuration requirements, see "Configuring Java SE Applications to Use OPSS" in Securing Applications with Oracle Platform Security Services.

Example: Basic Authentication

For example, to support basic authentication, using the oracle/wss_http_token_client_policy security policy, perform the following steps:

a. Copy the jps-config-jse.xml and audit-store.xml files from the domain_home/config/fmwconfig directory, where domain_home is the name and location of the domain, to a location that is accessible to the web service client.

b. Create a wallet (cwallet.sso) in the same location that you copied the files in step 2 that defines a map called oracle.wsm.security and the credential key name that the client application will use (for example, weblogic-csf-key).

The location of the file cwallet.sso is specified in the configuration file jps-config-jse.xml with the element <serviceInstance>. For more information, see "Using a Wallet-based Credential Store" in Securing Applications with Oracle Platform Security Services.

c. On the Java command line, pass the following property defining the JPS configuration file copied in step 1:

-Doracle.security.jps.config=<pathToConfigFile>

For more information, see "Scenario 3: Securing a Java SE Application" in Securing Applications with Oracle Platform Security Services.

Example: SSL

For example, to support SSL policies, perform the following steps:

a. Copy the jps-config-jse.xml and audit-store.xml files from the domain_home/config/fmwconfig directory, where domain_home is the name and location of the domain, to a location that is accessible to the web service client.

b. On the Java command line, pass the following properties defining the JPS configuration file copied in step 1:

Define the JPS configuration file copied in step 1:

-Doracle.security.jps.config=<pathToConfigFile>

For more information, see "Scenario 3: Securing a Java SE Application" in Securing Applications with Oracle Platform Security Services.

Define the trust store containing the trusted certificates:

-Djavax.net.ssl.trustStore=<trustStore>

For more information, see "Setting Up the WebLogic Server in Case of a Java SE Application" in "Setting Up a One-Way SSL Connection to the LDAP" in Securing Applications with Oracle Platform Security Services.

Define the trust store password:

-Djavax.net.ssl.trustStorePassword=<password>
8.4 Invoking a Web Service from Another WebLogic Web Service

Invoking a web service from a Java EE client, such as another WebLogic web service, is similar to invoking one from a Java SE application, as described in Section 8.2, "Invoking a Web Service from a Java SE Client," with the following variation:

- Instead of using the clientgen Ant task to generate the JAX-WS Service interface of the web service to be invoked, you use the <clientgen> child element of the <jws> element, inside the jwsc Ant task that compiles the invoking web service. In the JWS file that invokes the other web service, however, you still use the same standard JAX-WS APIs to get Service and PortType instances to invoke the web service operations.

- You can use the @WebServiceRef annotation to define a reference to a web service, as described in Section 8.4.2, "Sample JWS File That Invokes a Web Service."

This section describes the differences between invoking a web service from a client in a Java EE component, specifically another web service, and invoking from a Java SE client. It is assumed that you use Ant in your development environment to build your client application, compile Java files, and so on, and that you have an existing build.xml that builds a web service that you want to update to invoke another web service.

The following list describes the changes you must make to the build.xml file that builds your client web service, which will invoke another web service. See Section 8.4.1, "Sample build.xml File for a Web Service Client" for the full sample build.xml file:

- Add a <clientgen> child element to the <jws> element that specifies the JWS file that implements the web service that invokes another web service. Set the required wsdl attribute to the WSDL of the web service to be invoked. Set the required packageName attribute to the package into which you want the JAX-WS client stubs to be generated.

The following list describes the changes you must make to the JWS file that implements the client web service; see Section 8.4.2, "Sample JWS File That Invokes a Web Service" for the full JWS file example.

- Import the files generated by the <clientgen> child element of the jwsc Ant task. These include the JAX-WS Service interface of the invoked web service, as well as the Java representation of any user-defined data types used as parameters or return values in the operations of the invoked web service.

  Note: If the package name set using the packageName attribute of <clientgen> is set to the same package name as the client application, then you are not required to import the <clientgen>-generated files.

- Get the Service and PortType interface implementation and invoke the operation on the port as usual; see Section 8.2.3, "Writing the Java Client Application Code to Invoke a Web Service" for details.

8.4.1 Sample build.xml File for a Web Service Client

The following sample build.xml file shows how to create a web service that itself invokes another web service; the relevant sections that differ from the build.xml for building a simple web service that does not invoke another web service are shown in bold.
The build-service target in this case is very similar to a target that builds a simple web service; the only difference is that the jwsc Ant task that builds the invoking web service also includes a clientgen child element of the jws element so that jwsc also generates the required JAX-WS client stubs.

```xml
<project name="webservices-service_to_service" default="all">
  <!-- set global properties for this build -->
  <property name="wls.username" value="weblogic"/>
  <property name="wls.password" value="weblogic"/>
  <property name="wls.hostname" value="localhost"/>
  <property name="wls.port" value="7001"/>
  <property name="wls.server.name" value="myserver"/>
  <property name="ear.deployed.name" value="ClientServiceEar"/>
  <property name="example-output" value="output"/>
  <property name="ear-dir" value="$(example-output)/ClientServiceEar"/>
  <property name="clientclass-dir" value="$(example-output)/clientclasses"/>
  <path id="client.class.path">
    <pathelement path="${clientclass-dir}"/>
    <pathelement path="${java.class.path}"/>
  </path>
  <taskdef name="jwsc" classname="weblogic.wsee.tools.anttasks.JwscTask"/>
  <taskdef name="clientgen" classname="weblogic.wsee.tools.anttasks.ClientGenTask"/>
  <taskdef name="wldeploy" classname="weblogic.ant.taskdefs.management.WLDeploy"/>
  <target name="all" depends="clean,build-service,deploy,client"/>
  <target name="clean" depends="undeploy">
    <delete dir="${example-output}"/>
  </target>
  <target name="build-service">
    <jwsc srcdir="src" destdir="${ear-dir}">
      <jws file="examples/webservices/service_to_service/ClientServiceImpl.java" type="JAXWS">
        <clientgen wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL" packageName="examples.webservices.complex"/>
      </jws>
    </jwsc>
  </target>
  <target name="deploy">
    <wldeploy action="deploy" name="${ear.deployed.name}" source="${ear-dir}" user="${wls.username}" password="${wls.password}" verbose="true" adminurl="t3://${wls.hostname}:${wls.port}" targets="${wls.server.name}"/>
  </target>
  <target name="undeploy">
    <wldeploy action="undeploy" name="${ear.deployed.name}" failonerror="false" user="${wls.username}" password="${wls.password}" verbose="true" adminurl="t3://${wls.hostname}:${wls.port}" targets="${wls.server.name}"/>
  </target>
  <target name="client"/>
</project>
```
8.4.2 Sample JWS File That Invokes a Web Service

The following sample JWS file, called ClientServiceImpl.java, implements a web service called ClientService that has an operation that in turn invokes the echoComplexType operation of a web service called ComplexService. This operation has a user-defined data type (BasicStruct) as both a parameter and a return value. The relevant code is shown in bold and described after the example.

```java
package examples.webservices.service_to_service;
import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.xml.ws.WebServiceRef;
// Import the BasicStruct data type, generated by clientgen and used
// by the ComplexService Web Service
import examples.webservices.complex.BasicStruct;

// Import the JAX-WS stubs generated by clientgen for invoking
// the ComplexService web service.
import examples.webservices.complex.ComplexPortType;
import examples.webservices.complex.ComplexService;

@WebService(name="ClientPortType", serviceName="ClientService",
    targetNamespace="http://examples.org")
public class ClientServiceImpl {
    // Use the @WebServiceRef annotation to define a reference to a web service.
    @WebServiceRef()
    ComplexService test;

    @WebMethod()
    public String callComplexService(BasicStruct input, String serviceUrl) {
        // Create a port stub to invoke ComplexService
        ComplexPortType port = test.getComplexPortTypePort();

        // Invoke the echoComplexType operation of ComplexService
        BasicStruct result = port.echoComplexType(input);
```

---

8.4.2 Sample JWS File That Invokes a Web Service

The following sample JWS file, called ClientServiceImpl.java, implements a web service called ClientService that has an operation that in turn invokes the echoComplexType operation of a web service called ComplexService. This operation has a user-defined data type (BasicStruct) as both a parameter and a return value. The relevant code is shown in bold and described after the example.

```java
package examples.webservices.service_to_service;
import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.xml.ws.WebServiceRef;
// Import the BasicStruct data type, generated by clientgen and used
// by the ComplexService Web Service
import examples.webservices.complex.BasicStruct;

// Import the JAX-WS stubs generated by clientgen for invoking
// the ComplexService web service.
import examples.webservices.complex.ComplexPortType;
import examples.webservices.complex.ComplexService;

@WebService(name="ClientPortType", serviceName="ClientService",
    targetNamespace="http://examples.org")
public class ClientServiceImpl {
    // Use the @WebServiceRef annotation to define a reference to a web service.
    @WebServiceRef()
    ComplexService test;

    @WebMethod()
    public String callComplexService(BasicStruct input, String serviceUrl) {
        // Create a port stub to invoke ComplexService
        ComplexPortType port = test.getComplexPortTypePort();

        // Invoke the echoComplexType operation of ComplexService
        BasicStruct result = port.echoComplexType(input);
```
System.out.println("Invoked ComplexPortType.echoComplexType." );
return "Invoke went okay! Here's the result: ", " + result.getIntValue() + ", " + result.getStringValue() + ");
}

Follow these guidelines when programming the JWS file that invokes another web service; code snippets of the guidelines are shown in bold in the preceding example:

- Import any user-defined data types that are used by the invoked web service. In this example, the ComplexService uses the BasicStruct JavaBean:
  ```java
  import examples.webservices.complex.BasicStruct;
  ```

- Import the JAX-WS interfaces of the ComplexService web service; the stubs are generated by the <cliengen> child element of <jws>:
  ```java
  import examples.webservices.complex.ComplexPortType;
  import examples.webservices.complex.ComplexService;
  ```

- Define a reference to a web service and an injection target for it using the @WebServiceRef annotation:
  ```java
  @WebServiceRef()
  ComplexService service;
  ```
  For more information about @WebServiceRef, see Section 8.6, "Defining a Web Service Reference Using the @WebServiceRef Annotation."

  Alternatively, you can create a proxy stub to the ComplexService web service, as shown below:
  ```java
  ComplexService service = new ComplexService();
  ```

- Return an instance of the ComplexPortType stub implementation by calling the getComplexPortTypePort() operation on the web service reference:
  ```java
  ComplexPortType port = service.getComplexPortTypePort();
  ```

- Invoke the echoComplexType operation of ComplexService using the port you just instantiated:
  ```java
  BasicStruct result = port.echoComplexType(input);
  ```

8.5 Configuring Web Service Clients

By default, web service clients use the web service configuration defined for the server. You can override the configuration settings used by the web service client using one of the following methods:

- Using the Administration or WLST, if applicable. Only a subset of web service features are configurable on the client.

- Using the @WebServiceRef annotation to associate the web service client with the configuration defined for the specified web service reference. The web service reference configuration is defined in the weblogic.xml for Web containers and weblogic-ejb-jar.xml for EJB containers. For more information about the @WebServiceRef annotation, see Section 8.6, "Defining a Web Service Reference Using the @WebServiceRef Annotation."
8.6 Defining a Web Service Reference Using the @WebServiceRef Annotation

The @WebServiceRef annotation enables you to define a reference to a web service and attach the configuration of the web service to the client instance.

For example, in the following code excerpt, @WebServiceRef is used to attach the configuration for ReliableEchoService to the client's web service instance. The port that is subsequently created and initialized uses the properties defined for ReliableEchoService service reference in the weblogic.xml for the Web application.

```java
package wsrm_jaxws.example;
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
...
@WebService
public class ClientServiceImpl {
    @WebServiceRef(name="MyServiceRef")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;

    @PostConstruct
    public void initPort() {
        port = service.getReliableEchoPort();
        ...
    }
}
```

Example 8–1 shows an example of a weblogic.xml file that contains a web service reference description. For information about the reliable messaging properties shown in this example, see Section 14.7, "Configuring Reliable Messaging."

```
<?xml version='1.0' encoding='UTF-8'?>
<weblogic-web-app xmlns="http://xmlns.oracle.com/weblogic/weblogic-web-app">
<service-reference-description>
    <!-- Any name you want, but use this same name on
     @WebServiceRef(name=<my name>). This anno goes on the service
     field in your client container -->
    <service-ref-name>MyServiceRef</service-ref-name>
    <!-- Use / and any path within the web app to get a local WSDL, or
     use a resource name as defined by the Java ClassLoader, or use an
     absolute/external URL you can guarantee is deployed when this web
     app deploys -->
    <wsdl-url>/WEB-INF/wsdls/ReliableEcho.wsdl</wsdl-url>
    <!-- One or more port-infos, one for each type of port/stub you'll create
     in your JWS -->
    <port-info>
        <!-- The local name of wsdl:port (not portType). The Java type for this
        port, when created from the @WebServiceRef JWS field, will contain,
        in RequestContext, the props you define below -->
```
<port-name>ReliableEchoPort</port-name>

<!-- Any prop name/value pairs you want to show up on you service stub
     The Java type for this port, when created from the @WebServiceRef JWS field,
     will contain, in RequestContext, the stub-props you define below -->

<!-- RM Source Properties -->
<stub-property>
  <name>weblogic.wsee.wsrmi.BaseRetransmissionInterval</name>
  <value>PT30S</value>
</stub-property>

<stub-property>
  <name>weblogic.wsee.wsrmi.RetransmissionExponentialBackoff</name>
  <value>true</value>
</stub-property>

<!-- RM Destination Properties -->
<stub-property>
  <name>weblogic.wsee.wsrmi.RetryCount</name>
  <value>5</value>
</stub-property>

<stub-property>
  <name>weblogic.wsee.wsrmi.RetryDelay</name>
  <value>PT30S</value>
</stub-property>

<stub-property>
  <name>weblogic.wsee.wsrmi.AcknowledgementInterval</name>
  <value>PT5S</value>
</stub-property>

<stub-property>
  <name>weblogic.wsee.wsrmi.NonBufferedDestination</name>
  <value>true</value>
</stub-property>

<!-- RM Source *or* Destination Properties -->
<stub-property>
  <name>weblogic.wsee.wsrmi.InactivityTimeout</name>
  <value>PT5M</value>
</stub-property>

<stub-property>
  <name>weblogic.wsee.wsrmi.SequenceExpiration</name>
  <value>PT10M</value>
</stub-property>

</port-info>

</service-reference-description>
<wl-dispatch-policy>weblogic.wsee.mdb.DispatchPolicy</wl-dispatch-policy>
</weblogic-web-app>
8.7 Managing Client Identity

Web services enable you to assign any meaningful name to a client, which is represented as the client identity (client ID). This client ID is used to group statistics and other monitoring information, and for reporting runtime validations, and so on.

For on-server clients (clients running in a container within a WebLogic Server instance), the client ID can be generated in one of the following ways:

- By the client when it initializes connection to web service port. This is the recommended approach. See Section 8.7.1, "Defining the Client ID During Port Initialization".
- By the server and discovered later by the client. See Section 8.7.2, "Accessing the Server-generated Client ID".

Note: Although optional, Oracle strongly recommends that you define the client ID explicitly.

The `weblogic.wsee.jaxws.persistence.ClientIdentityFeature` client feature enables web service clients to set and access the web service client ID. The following table summarizes the `ClientIdentityFeature` methods.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>getClientID()</code></td>
<td>Gets the currently defined client ID for the web service port.</td>
</tr>
<tr>
<td><code>setClientID()</code></td>
<td>Sets the client ID for the web service port.</td>
</tr>
<tr>
<td></td>
<td>In addition, you can set the client ID by passing it as an argument when instantiating the <code>ClientIdentityFeature</code> object. For example:</td>
</tr>
<tr>
<td></td>
<td><code>ClientIdentityFeature clientIDFeature = new ClientIdentityFeature(&quot;MyBackendServiceAsyncClient&quot;);</code></td>
</tr>
<tr>
<td><code>dispose()</code></td>
<td>Disposes the client ID. If a client ID is not disposed of explicitly, it will be done when the container for the client instances that use the client ID is deactivated (for example, the host Web application or EJB is deactivated). For more information, see Section 8.7.3, &quot;Client Identity Lifecycle.&quot;</td>
</tr>
</tbody>
</table>

The following sections describe the methods for managing the client ID:

- Section 8.7.1, "Defining the Client ID During Port Initialization"
- Section 8.7.2, "Accessing the Server-generated Client ID"
- Section 8.7.3, "Client Identity Lifecycle"

8.7.1 Defining the Client ID During Port Initialization

To provide its client ID, the web service client can pass an instance of the `ClientIdentityFeature` containing the client ID to the web service port at initialization time.

The client ID must be unique within the Web application or EJB that contains the client. It is recommended that the client ID appropriately reflect the business purpose. In order to ensure that the client ID is unique, the system prepends the names of the
containing server, application, and component (Web application or EJB) to the client ID.

Notes: Care should be taken when choosing a client ID. If a client instance is created with the same client ID as an existing client instance, the two client instances will be treated as the same instance. No exception will be thrown to alert you to the duplication.

The following example demonstrates this method of specifying the client ID. It is recommended that you close the client instance once all processing has been complete, as shown.

This example is excerpted from Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients."

**Example 8–2 Example of Specifying the Client ID During Port Initialization**

```java
import javax.servlet.*;
import javax.xml.ws.*;
import weblogic.jws.jaxws.client.ClientIdentityFeature;
...
public class BestPracticeAsyncClient
    extends GenericServlet {
    ...
    private BackendServiceService _service;
    ...
    // Client ID
    ClientIdentityFeature clientIdFeature =
        new ClientIdentityFeature("MyBackendServiceAsyncClient");
    features.add(clientIdFeature);
    ...
    _features = features.toArray(new WebServiceFeature[features.size()]);
    ...
    BackendService port = _service.getBackendServicePort(_features);
    ...
    ((java.io.Closeable)_port).close();
}
```

### 8.7.2 Accessing the Server-generated Client ID

Note: As described in this section, in order to ensure that the client ID is unique, the server-generated version may be long and difficult to read. To guarantee that the client ID is presented in a user-friendly format, it is recommended that you define the client ID during port initialization, as described in Section 8.7.1, "Defining the Client ID During Port Initialization".

Client IDs that are generated automatically by the server use the following format:

```
applicationname[_applicationversion]:componentname:uniqueID
```

Where:
- **applicationname**—Name of the application hosting the client.
Managing Client Identity

- **applicationversion**—Version of the application. Only used if multiple versions of the same application is running simultaneously.

- **componentname**—Name of the component (Web application or EJB) hosting the client.

- **uniqueID**—Calculated based on the information that is available when the client instance is created. The uniqueID is constructed by choosing one of the following (whichever is available):
  - Web service reference name, as defined by the `@WebServiceRef` annotation.
  - `[portNamespaceURI:portLocalName][:][endpointAddress]`—port name, endpoint address, or both (separated by a colon).
  - Port class simple name.

The following information, when available, may also be concatenated to the uniqueID, separated by a colon (:), in the order presented below:

- WSDL location (minus `?wsdl`)
- Features used to create the client instance, represented by the features class name and separated by dash (-).

For example, assume that you deploy a web service client with the following information associated with it:

- **Application name**: example
- **Component**: Web application called **BestPracticeClient**
- **Port name**: `http://example/BackendServicePort`
- **Port class**: `BackendService`
- **WSDL**:
  - `jar:file:/C:/example/BackendService.war!/WEB-INF/BackendServiceService.wsdl`

The server-generated client ID will be:

```
example:BestPracticeClient:http://example/:BackendServicePort:jar:file:/C:/example /BackendService.war!/WEB-INF/BackendServiceService.wsdl:AsyncClientTransportFeature()-ClientIdentityFeature
```

Each time the code is executed, assuming it is in the same containment hierarchy, the same client ID is generated. This provides a stable client ID that can be used across server VM instances and allows for asynchronous responses to be delivered to the client even after a server restart.

**Note:** A given Client ID can be used from multiple locations in the client code, but care should be taken to initialize any port or Dispatch instance that uses that client ID in the same way (same features, service, and so on) as was used in any other location for that client ID.

For best practice information on the recommended approach to client instance (port or Dispatch) initialization, see Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients."

The following example demonstrates how to access the server-generated client ID. This example is excerpted from "Roadmap for Developing Web Service Clients" on page 7-1.
Example 8–3 Example of Accessing the Server-generated Client ID

```
// Create a port without explicitly defining the client ID to view the client ID that is
// generated automatically.
ClientIdentityFeature dummyClientIdFeature = new ClientIdentityFeature(null);
BackendService dummyPort = _service.getBackendServicePort(dummyClientIdFeature);
System.out.println("Generated Client Identity is: " + dummyClientIdFeature.getClientId());
```

// Best Practice: Explicitly close client instances when processing is complete.
// If not closed, the port will be closed automatically when it goes out of scope.
// Note, this client ID will remain registered and visible until our
// container (Web application) is undeployed.
((java.io.Closeable)dummyPort).close();

8.7.3 Client Identity Lifecycle

A client ID is registered with the web services runtime when the first client instance
(port or Dispatch instance) using the client ID is created. Any asynchronous response
endpoint associated with the client instances is also tracked along with the registered
client ID.

The client ID remains registered until one of the following occurs:

- The client ID is explicitly disposed using the dispose() method on
  ClientIdentityFeature, as described in Table 8–3.
- The container for the client instances that use the client ID is deactivated (for
  example, the host Web application or EJB is deactivated).

8.8 Using a Proxy Server When Invoking a Web Service

You can use a proxy server to proxy requests from a client application to an
application server (either WebLogic or non-WebLogic) that hosts the invoked web
service. You typically use a proxy server when the application server is behind a
firewall. You can specify the proxy server in your client application using Java system
properties. There are two ways to specify the proxy server in your client application:
programmatically using the WebLogic ClientProxyFeature API or using system
properties.

8.8.1 Using the ClientProxyFeature API to Specify the Proxy Server

You can programmatically specify within the Java client application itself the details of
the proxy server that will proxy the web service invoke using the
weblogic.wsee.jaxws.proxy.ClientProxyFeature API. For more about the
ClientProxyFeature API, see the Java API Reference for Oracle WebLogic Server.

The proxy server settings defined by the ClientProxyFeature override the settings
defined at the JVM-level, as described in Section 8.8.2, "Using System Properties to
Specify the Proxy Server".
You can configure the proxy server information using the ClientProxyFeature and pass the feature as an argument when creating the web service port, as shown in the following example.

**Example 8–4 Pass ClientProxyFeature as an Argument When Creating Port**

```java
package examples.webservices.simple_client;
import weblogic.wsee.jaxws.proxy;
public class Main {
    public static void main(String[] args) {
        ComplexService test = new ComplexService();
        ClientProxyFeature cpf = new ClientProxyFeature();
        cpf.setProxyHost("localhost");
        cpf.setProxyPort(8888);
        cpf.setProxyUserName("proxyu");
        cpf.setProxyPassword("proxyp");
        ComplexPortType port = test.getComplexPortTypePort(cpf);
        BasicStruct in = new BasicStruct();
        in.setIntValue(999);
        in.setStringValue("Hello Struct");
        BasicStruct result = port.echoComplexType(in);
        System.out.println("echoComplexType called. Result: \\
                          + result.getIntValue() + ", \\
                          + result.getStringValue());
    }
}
```

Alternatively, you can configure the proxy server information after the port is created, as shown in the following example. In this case, you execute the attachsPort() method to attach the ClientProxyFeature to the existing port.

**Example 8–5 Configuring the ClientProxyFeature After Creating the Port**

```java
package examples.webservices.simple_client;
import weblogic.wsee.jaxws.proxy;
public class Main {
    public static void main(String[] args) {
        ComplexService test = new ComplexService();
        ComplexPortType port = test.getComplexPortTypePort();
        ClientProxyFeature cpf = new ClientProxyFeature();
        cpf.setProxyHost("localhost");
        cpf.setProxyPort(8888);
        cpf.setProxyUserName("proxyu");
        cpf.setProxyPassword("proxyp");
        cpf.attachsPort(port);
        BasicStruct in = new BasicStruct();
        in.setIntValue(999);
        in.setStringValue("Hello Struct");
```

*Note:* The ClientProxyFeature configures the port for WebLogic HTTP over SSL. It is recommended that you configure SSL for WebLogic Server. For more information, see "Configuring SSL" in *Administering Security for Oracle WebLogic Server 12c (12.2.1).*

The ClientProxyFeature setUseSunHttpHandler method forces WebLogic Server to use the Sun HTTP implementation on a per-connection-request basis. You can instead use the -DUseSunHttpHandler=true WebLogic Server startup configuration option, which applies the setting for the WebLogic Server instance.
BasicStruct result = port.echoComplexType(in);
System.out.println("echoComplexType called. Result: " + result.getIntValue() + ", " +
result.getStringValue());
}
}

If after configuring the ClientProxyFeature and attaching it to the port you want to
disable the client proxy settings, you set the proxy port to a negative value. For
example:

**Example 8–6 Disabling Client Proxy Settings**

```java
...
ClientProxyFeature cpf = new ClientProxyFeature();
cpf.setProxyPort(-1);
cpf.attachsPort(port);
...
```

### 8.8.2 Using System Properties to Specify the Proxy Server

To use system properties to specify the proxy server, write your client application in
the standard way, and then specify Java system properties when you execute the client
application.

The following table summarizes the Java system properties.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>http.proxyHost=proxyHost</td>
<td>Name of the host computer on which the proxy server is running. Use https.proxyHost for HTTP over SSL.</td>
</tr>
<tr>
<td>or https.proxyHost=proxyHost</td>
<td></td>
</tr>
<tr>
<td>http.proxyPort=proxyPort</td>
<td>Port to which the proxy server is listening. Use https.proxyPort for HTTP over SSL.</td>
</tr>
<tr>
<td>or https.proxy.Port=proxyPort</td>
<td></td>
</tr>
<tr>
<td>http.nonProxyHosts=hostname</td>
<td>List of hosts that should be reached directly, bypassing the proxy. Separate each host name using a</td>
</tr>
</tbody>
</table>

The following excerpt from an Ant build script shows an example of setting Java
system properties when invoking a client application called
clients.InvokeMyService:

```xml
<target name="run-client">
  <java fork="true"
    classname="clients.InvokeMyService"
    failonerror="true">
    <classpath refid="client.class.path"/>
    <arg line="${http-endpoint}"/>
    <jvmarg line="-Dhttp.proxyHost=${proxy-host} -Dhttp.proxyPort=${proxy-port} -Dhttp.nonProxyHosts=${myhost}"/>
  </java>
</target>
```

---

**Note:** In this case, the proxySet system property must not be set. If
the proxySet system property is set to (proxySet=false), proxy
properties will be ignored and no proxy will be used.
8.9 Client Considerations When Redeploying a Web Service

WebLogic Server supports production redeployment, which means that you can deploy a new version of an updated WebLogic web service alongside an older version of the same web service.

WebLogic Server automatically manages client connections so that only new client requests are directed to the new version. Clients already connected to the web service during the redeployment continue to use the older version of the service until they complete their work, at which point WebLogic Server automatically retires the older web service.

You can continue using the old client application with the new version of the web service, as long as the following web service artifacts have not changed in the new version:

- WSDL that describes the web service
- WS-Policy files attached to the web service

If any of these artifacts have changed, you must regenerate the JAX-WS stubs used by the client application by re-running the `clientgen` Ant task.

For example, if you change the signature of an operation in the new version of the web service, then the WSDL file that describes the new version of the web service will also change. In this case, you must regenerate the JAX-WS stubs. If, however, you simply change the implementation of an operation, but do not change its public contract, then you can continue using the existing client application.

8.10 Client Considerations When Web Service and Client Are Deployed to the Same Managed Server

If a web service and client are deployed to the same Managed Server, and one of the following is true:

- The web service client uses the `@WebServiceRef` annotation, but does not specify a value for the `wsdlLocation` element.
- The web service client uses the `wsdlLocation` element of the `@WebServiceRef` annotation to refer to the live WSDL location (for example, `@WebServiceRef(wsdlLocation="http://xyz.com/myService?WSDL")`), as opposed to a WSDL that is packaged with the web service application (for example, `@WebServiceRef(wsdlLocation="myService.wsdl")`).

Then, when you restart the Managed Server on which the web service and client are deployed, the web service client may fail to redeploy, regardless of the deployment order, because the applications are deployed initially in administration mode, and later transition to production mode to accept HTTP requests. In this situation, you must restart the application manually once the server has restarted.

If a web service and client are deployed to the same Managed Server, to avoid this situation, it is recommended that you package the WSDL as part of the web service application and refer to the packaged version from the `@WebServiceRef` annotation.
This chapter provides some common examples of developing WebLogic web service clients using Java API for XML-based Web services (JAX-WS).

This chapter includes the following sections:

- Section 9.1, "Developing a JAX-WS Java SE Client"
- Section 9.2, "Invoking a Web Service from a WebLogic Web Service"

Each example provides step-by-step procedures for creating simple WebLogic web services and invoking an operation from a deployed web service. The examples include basic Java code and Ant build.xml files that you can use in your own development environment to recreate the example, or by following the instructions to create and run the examples in an environment that is separate from your development environment.

The examples do not go into detail about the processes and tools used in the examples; later chapters are referenced for more detail.

---

**Note:** For best practice examples demonstrating advanced web service features, see Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients" and Chapter 13, "Roadmap for Developing Reliable Web Services and Clients."

---

### 9.1 Developing a JAX-WS Java SE Client

**Note:** You can invoke a web service from any Java SE or Java EE application running on WebLogic Server (with access to the WebLogic Server classpath). Invoking a web service from standalone Java applications that are running in an environment where WebLogic Server libraries are not available is not supported in this release for JAX-WS web services.

When you invoke an operation of a deployed web service from a client application, the web service could be deployed to WebLogic Server or to any other application server, such as .NET. All you need to know is the URL to its public contract file, or WSDL.

In addition to writing the Java client application, you must also run the clientgen WebLogic web service Ant task to generate the artifacts that your client application needs to invoke the web service operation. These artifacts include:
Developing a JAX-WS Java SE Client

- The Java class for the `Service` interface implementation for the particular web service you want to invoke.
- JAXB data binding artifacts.
- The Java class for any user-defined XML Schema data types included in the WSDL file.

The following example shows how to create a Java client application that invokes the `echoComplexType` operation of the `ComplexService` WebLogic web service described in Section 6.2, "Creating a Web Service With User-Defined Data Types." The `echoComplexType` operation takes as both a parameter and return type the `BasicStruct` user-defined data type.

---

**Note:** It is assumed in this procedure that you have created and deployed the `ComplexService` web service.

---

1. Set your WebLogic Server environment.
   
   Open a command window and execute the `setDomainEnv.cmd` (Windows) or `setDomainEnv.sh` (UNIX) script, located in the `bin` subdirectory of your domain directory. The default location of WebLogic Server domains is `ORACLE_HOME/user_projects/domains/domainName`, where `ORACLE_HOME` is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and `domainName` is the name of your domain.

2. Create a project directory:
   
   ```
   prompt> mkdir /myExamples/simple_client
   ```

3. Create a `src` directory under the project directory, as well as subdirectories that correspond to the package name of the Java client application (shown later on in this procedure):
   
   ```
   prompt> cd /myExamples/simple_client
   prompt> mkdir src/examples/webservices/simple_client
   ```

4. Create a standard Ant `build.xml` file in the project directory and add a `taskdef` Ant task to specify the full Java class name of the `clientgen` task:

   ```xml
   <project name="webservices-simple_client" default="all">
     <taskdef name="clientgen" classname="weblogic.wsee.tools.anttasks.ClientGenTask" />
   </project>
   ```

   See Section 9.1.2, "Sample Ant Build File For Building Java Client Application" for a full sample `build.xml` file. The full `build.xml` file uses properties, such as `${clientclass-dir}`, rather than always using the hard-coded name output directory for client classes.

5. Add the following calls to the `clientgen` and `javac` Ant tasks to the `build.xml` file, wrapped inside of the `build-client` target:

   ```xml
   <target name="build-client">
     <clientgen
       wsdll="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
       destDir="output/clientclass"
       packageName="examples.webservices.simple_client"
       type="JAXWS"/>
     <javac
   ```

---

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Developing a JAX-WS Java SE Client

Examples of Developing JAX-WS Web Service Clients

6. Create the Java client application file that invokes the `echoComplexType` operation.

   Open your favorite Java IDE or text editor and create a Java file called `Main.java` using the code specified in Section 9.1.1, "Sample Java Client Application."

   The application follows standard JAX-WS guidelines to invoke an operation of the web service using the web service-specific implementation of the `Service` interface generated by `clientgen`. For details, see Chapter 8, "Developing Web Service Clients."

   9. Add the following targets to the `build.xml` file, used to execute the `Main` application:

   ```xml
   <path id="client.class.path">
   <javac
     srcdir='src' destdir='output/clientclass'
     includes='**/*.java'/>
   <target>
   </target>
   ```

   The `clientgen` Ant task uses the WSDL of the deployed `ComplexService` web service to generate the necessary artifacts and puts them into the output/clientclass directory, using the specified package name. Replace the variables with the actual hostname and port of your WebLogic Server instance that is hosting the web service.

   In this example, the package name is set to the same package name as the client application, `examples.webservices.simple_client`. If you set the package name to one that is different from the client application, you would need to import the appropriate class files. For example, if you defined the package name as `examples.webservices.complex`, you would need to import the following class files in the client application:

   ```java
   import examples.webservices.complex.BasicStruct;
   import examples.webservices.complex.ComplexPortType;
   import examples.webservices.complex.ComplexService;
   ```

   The `clientgen` Ant task also automatically generates the `examples.webservices.simple_client.BasicStruct` JavaBean class, which is the Java representation of the user-defined data type specified in the WSDL.

   The `build-client` target also specifies the standard `javac` Ant task, in addition to `clientgen`, to compile all the Java code, including the Java program described in the next step, into class files.

   The `clientgen` Ant task also provides the `destFile` attribute if you want the Ant task to automatically compile the generated Java code and package all artifacts into a JAR file. For details and an example, see "clientgen" in the WebLogic Web Services Reference for Oracle WebLogic Server.
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9.1.1 Sample Java Client Application

The following provides a simple Java client application that invokes the `echoComplexType` operation. Because the `<clientgen>` `packageName` attribute was set to the same package name as the client application, we are not required to import the `<clientgen>`-generated files.

```java
package examples.webservices.simple_client;

/*
 * This is a simple Java application that invokes the
 * `echoComplexType` operation of the ComplexService web service.
 */
public class Main {
    public static void main(String[] args) {
        ComplexService test = new ComplexService();
        ComplexPortType port = test.getComplexPortTypePort();
        BasicStruct in = new BasicStruct();
        in.setIntValue(999);
        in.setStringValue("Hello Struct");
        BasicStruct result = port.echoComplexType(in);
        System.out.println("echoComplexType called. Result: "+ result.getIntValue() + ", " + result.getStringValue());
    }
}
```

9.1.2 Sample Ant Build File For Building Java Client Application

The following `build.xml` file defines tasks to build the Java client application. The example uses properties to simplify the file.

```xml
<project name="webservices-simple_client" default="all">
    <!-- set global properties for this build -->
</project>
```

The run target invokes the `Main` application, passing it the WSDL URL of the deployed web service as its single argument. The `classpath` element adds the `clientclass` directory to the CLASSPATH, using the reference created with the `<path>` task.

10. Execute the run target to invoke the `echoComplexType` operation:

```
prompt> ant run
```

If the invoke was successful, you should see the following final output:

```
run:
    [java] echoComplexType called. Result: 999, Hello Struct
```

You can use the `build-client` and `run` targets in the `build.xml` file to iteratively update, rebuild, and run the Java client application as part of your development process.
<property name="wls.hostname" value="localhost"/>
<property name="wls.port" value="7001"/>
<property name="example-output" value="output"/>
<property name="clientclass-dir" value="${example-output}/clientclass"/>
<path id="client.class.path">
  <pathelement path="${clientclass-dir}"/>
  <pathelement path="${java.class.path}"/>
</path>
<taskdef name="clientgen" classname="weblogic.wsee.tools.anttasks.ClientGenTask"/>
<target name="clean">
  <delete dir="${clientclass-dir}"/>
</target>
<target name="all" depends="clean,build-client,run"/>
<target name="build-client">
  <clientgen type="JAXWS"
            wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
            destDir="${clientclass-dir}"
            packageName="examples.webservices.simple_client"/>
  <javac srcdir="${clientclass-dir}" destdir="${clientclass-dir}"
       includes="**/*.java"/>
  <javac srcdir="src" destdir="${clientclass-dir}"
       includes="examples/webservices/simple_client/*.java"/>
</target>
<target name="run">
  <java fork="true"
    classname="examples.webservices.simple_client.Main"
    failonerror="true">
    <classpath refid="client.class.path"/>
  </java>
</target>
</project>

9.2 Invoking a Web Service from a WebLogic Web Service

You can invoke a web service (WebLogic, Microsoft .NET, and so on) from within a deployed WebLogic web service.

The procedure is similar to that described in Section 9.1, "Developing a JAX-WS Java SE Client" except that instead of running the clientgen Ant task to generate the client stubs, you use the <clientgen> child element of <jws>, inside of the jwsc Ant task. The jwsc Ant task automatically packages the generated client stubs in the invoking web service WAR file so that the web service has immediate access to them. You then follow standard JAX-WS programming guidelines in the JWS file that implements the web service that invokes the other web service.

The following example shows how to write a JWS file that invokes the echoComplexType operation of the ComplexService web service described in Section 6.2, "Creating a Web Service With User-Defined Data Types."

---

**Note:** It is assumed that you have successfully deployed the ComplexService web service.

1. Set your WebLogic Server environment.
Open a command window and execute the `setDomainEnv.cmd` (Windows) or `setDomainEnv.sh` (UNIX) script, located in the `bin` subdirectory of your domain directory. The default location of WebLogic Server domains is `ORACLE_HOME/user_projects/domains/domainName`, where `ORACLE_HOME` is the directory you specified as Oracle Home when you installed Oracle WebLogic Server and `domainName` is the name of your domain.

2. Create a project directory:
   ```
   prompt> mkdir /myExamples/service_to_service
   ```

3. Create a `src` directory under the project directory, as well as subdirectories that correspond to the package name of the JWS and client application files (shown later on in this procedure):
   ```
   prompt> cd /myExamples/service_to_service
   prompt> mkdir src/examples/webservices/service_to_service
   ```

4. Create the JWS file that implements the web service that invokes the ComplexService web service.

   Open your favorite Java IDE or text editor and create a Java file called `ClientServiceImpl.java` using the Java code specified in Section 9.2.1, “Sample ClientServiceImpl.java JWS File.”

   The sample JWS file shows a Java class called `ClientServiceImpl` that contains a single public method, `callComplexService()`. The Java class imports the JAX-WS stubs, generated later on by the `jwsc` Ant task, as well as the BasicStruct JavaBean (also generated by `clientgen`), which is the data type of the parameter and return value of the `echoComplexType` operation of the ComplexService web service.

   The `ClientServiceImpl` Java class defines one method, `callComplexService()`, which takes one parameter: a BasicStruct which is passed on to the `echoComplexType` operation of the ComplexService web service. The method then uses the standard JAX-WS APIs to get the Service and PortType of the ComplexService, using the stubs generated by `jwsc`, and then invokes the `echoComplexType` operation.

5. Save the `ClientServiceImpl.java` file in the `src/examples/webservices/service_to_service` directory.

6. Create a standard Ant `build.xml` file in the project directory and add the following task:
   ```xml
   <project name="webservices-service_to_service" default="all">
   <taskdef name="jwsc"
     classname="weblogic.wsee.tools.anttasks.JwscTask" />
   </project>
   ```

   The `taskdef` task defines the full classname of the `jwsc` Ant task.

   See Section 9.2.2, “Sample Ant Build File For Building ClientService” for a full sample `build.xml` file that contains additional targets from those described in this procedure, such as `clean`, `deploy`, `undeploy`, `client`, and `run`. The full `build.xml` file also uses properties, such as `$(ear-dir)`, rather than always using the hard-coded name for the EAR directory.

7. Add the following call to the `jwsc` Ant task to the `build.xml` file, wrapped inside of the `build-service` target:
   ```xml
   <target name="build-service">
   ```
In the preceding example, the `<clientgen>` child element of the `<jws>` element of the `jwsc` Ant task specifies that, in addition to compiling the JWS file, `jwsc` should also generate and compile the client artifacts needed to invoke the web service described by the WSDL file.

In this example, the package name is set to `examples.webservices.complex`, which is different from the client application package name, `examples.webservices.simple_client`. As a result, you need to import the appropriate class files in the client application:

```java
import examples.webservices.complex.BasicStruct;
import examples.webservices.complex.ComplexPortType;
import examples.webservices.complex.ComplexService;
```

If the package name is set to the same package name as the client application, the import calls would be optional.

8. Execute the `jwsc` Ant task by specifying the `build-service` target at the command line:

```bash
prompt> ant build-service
```

9. Start the WebLogic Server instance to which you will deploy the web service.

10. Deploy the web service, packaged in an Enterprise Application, to WebLogic Server, using either the WebLogic Server Administration Console or the `wldeploy` Ant task. In either case, you deploy the `ClientServiceEar` Enterprise application, located in the output directory.

To use the `wldeploy` Ant task, add the following target to the `build.xml` file:

```xml
<taskdef name="wldeploy"
    classname="weblogic.ant.taskdefs.management.WLDeploy"/>
<target name="deploy">
    <wldeploy action="deploy" name="ClientServiceEar"
        source="ClientServiceEar" user="$\{wls.username\}" password="$\{wls.password\}" verbose="true"
        adminurl="t3://$\{wls.hostname\}:$\{wls.port\}" targets="$\{wls.server.name\}" />
</target>
```

Substitute the values for `wls.username`, `wls.password`, `wls.hostname`, `wls.port`, and `wls.server.name` that correspond to your WebLogic Server instance.

Deploy the WAR file by executing the `deploy` target:
prompt> ant deploy

11. Test that the web service is deployed correctly by invoking its WSDL in your browser:

http://host:port/ClientService/ClientService?WSDL

See Section 9.1, "Developing a JAX-WS Java SE Client" for an example of creating a Java client application that invokes a web service.

9.2.1 Sample ClientServiceImpl.java JWS File

The following provides a simple web service client application that invokes the echoComplexType operation.

```java
package examples.webservices.service_to_service;

import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.xml.ws.WebServiceRef;

// Import the BasicStruct data type, generated by clientgen and used by the ComplexService Web Service
import examples.webservices.complex.BasicStruct;

// Import the JAX-WS stubs generated by clientgen for invoking the ComplexService web service.
import examples.webservices.complex.ComplexPortType;
import examples.webservices.complex.ComplexService;

@WebService(name="ClientPortType", serviceName="ClientService",
            targetNamespace="http://examples.org")
public class ClientServiceImpl {
    private ComplexService test;

    @WebMethod()
    public String callComplexService(BasicStruct input, String serviceUrl) {
        ComplexPortType port = test.getComplexPortTypePort();

        BasicStruct result = port.echoComplexType(input);

        System.out.println("Invoked ComplexPortType.echoComplexType.");
        return "Invoke went okay! Here's the result: '" + result.getIntValue() + ", " + result.getStringValue() + ";";
    }
}
```

9.2.2 Sample Ant Build File For Building ClientService

The following build.xml file defines tasks to build the client application. The example uses properties to simplify the file.

```xml
<project name="webservices-service_to_service" default="all">
```

---

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<!-- set global properties for this build -->
<property name="wls.username" value="weblogic" />
<property name="wls.password" value="weblogic" />
<property name="wls.hostname" value="localhost" />
<property name="wls.port" value="7001" />
<property name="wls.server.name" value="myserver" />
<property name="ear.deployed.name" value="ClientServiceEar" />
<property name="example-output" value="output" />
<property name="ear-dir" value="${example-output}/ClientServiceEar" />
<property name="clientclass-dir" value="${example-output}/clientclasses" />
<path id="client.class.path">
  <pathelement path="${clientclass-dir}"/>
  <pathelement path="${java.class.path}"/>
</path>
<taskdef name="jwsc" classname="weblogic.wsee.tools.anttasks.JwscTask" />
<taskdef name="clientgen" classname="weblogic.wsee.tools.anttasks.ClientGenTask" />
<taskdef name="wldeploy" classname="weblogic.ant.taskdefs.management.WLDeploy" />
<target name="all" depends="clean,build-service,deploy,client" />
<target name="clean" depends="undeploy">
  <delete dir="${example-output}"/>
</target>
<target name="build-service">
  <jwsc srcdir="src" destdir="${ear-dir}" >
    <jws type="JAXWS">
      <WLHttpTransport contextPath="ClientService" serviceUri="ClientService" portName="ClientServicePort"/>
      <clientgen type="JAXWS" wsd1="http://${wls.hostname}:${wls.port}/ClientService/ClientService?WSDL" packageName="examples.webservices.complex" />
    </jws>
  </jwsc>
</target>
<target name="deploy">
  <wldeploy action="deploy" name="${ear.deployed.name}" source="${ear-dir}" user="${wls.username}" password="${wls.password}" verbose="true" adminurl="t3://${wls.hostname}:${wls.port}" targets="${wls.server.name}" />
</target>
<target name="undeploy">
  <wldeploy action="undeploy" name="${ear.deployed.name}" failonerror="false" user="${wls.username}" password="${wls.password}" verbose="true" adminurl="t3://${wls.hostname}:${wls.port}" targets="${wls.server.name}" />
</target>
<target name="client">
  <clientgen wsd1="http://${wls.hostname}:${wls.port}/ComplexService/ComplexService?WSDL" destDir="${clientclass-dir}"
packageName="examples.webservices.service_to_service.client"
type="JAXWS"/>
<javac
   srcdir="${clientclass-dir}" destdir="${clientclass-dir}"
   includes="**/*.java"/>
<javac
   srcdir="src" destdir="${clientclass-dir}"
   includes="examples/webservices/service_to_service/client/**/*.java"/>
</target>
<target name="run">
   <java classname="examples.webservices.service_to_service.client.Main"
       fork="true"
       failonerror="true">
       <classpath refid="client.class.path"/>
   </java>
</target>
</project>
Part IV describes how to develop advanced features of WebLogic web services using Java API for XML-based Web services (JAX-WS).

Sections include:

- Chapter 10, "Using Web Services Addressing"
- Chapter 11, "Roadmap for Developing Asynchronous Web Service Clients"
- Chapter 12, "Developing Asynchronous Clients"
- Chapter 13, "Roadmap for Developing Reliable Web Services and Clients"
- Chapter 14, "Using Web Services Reliable Messaging"
- Chapter 15, "Using Web Services Atomic Transactions"
- Chapter 16, "Optimizing XML Transmission Using Fast Infoset"
- Chapter 17, "Using SOAP Over JMS Transport"
- Chapter 18, "Creating and Using SOAP Message Handlers"
- Chapter 19, "Handling Exceptions Using SOAP Faults"
- Chapter 20, "Optimizing Binary Data Transmission"
- Chapter 21, "Managing Web Service Persistence"
- Chapter 22, "Configuring Message Buffering for Web Services"
- Chapter 23, "Managing Web Services in a Cluster"
- Chapter 24, "Using Provider-based Endpoints and Dispatch Clients to Operate on SOAP Messages"
- Chapter 25, "Sending and Receiving SOAP Headers"
- Chapter 26, "Using Callbacks"
- Chapter 27, "Developing Dynamic Proxy Clients"
- Chapter 28, "Publishing a Web Service Endpoint"
- Chapter 29, "Using XML Catalogs"
- Chapter 30, "Programming Web Services Using XML Over HTTP"
- Chapter 31, "Programming Stateful JAX-WS Web Services Using HTTP Session"
- Chapter 32, "Testing and Monitoring Web Services"
10

Using Web Services Addressing

This chapter describes how to use Web Services Addressing (WS-Addressing) for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 10.1, "Overview of WS-Addressing"
- Section 10.2, "Enabling WS-Addressing on the Web Service"
- Section 10.3, "Enabling WS-Addressing on the Web Service Client"
- Section 10.4, "Associating WS-Addressing Action Properties"
- Section 10.5, "Configuring Anonymous WS-Addressing"

10.1 Overview of WS-Addressing

WS-Addressing provides a transport-neutral mechanism to address web services and their associated messages. Using WS-Addressing, endpoints are uniquely and unambiguously defined in the SOAP header.

WS-Addressing provides two key components that enable transport-neutral addressing, including:

- **Endpoint reference (EPR)**—Communicates the information required to address a web service endpoint.

- **Message addressing properties**—Communicates end-to-end message characteristics, including addressing for source and destination endpoints and message identity, that allows uniform addressing of messages independent of the underlying transport.

Message addressing properties can include one or more of the properties defined in Table 10–1. All properties are optional except `wsa:Action`.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>wsa:To</code></td>
<td>Destination. If not specified, the destination defaults to <a href="http://www.w3.org/2005/08/addressing/anonymous">http://www.w3.org/2005/08/addressing/anonymous</a>.</td>
</tr>
<tr>
<td><code>wsa:From</code></td>
<td>Source endpoint.</td>
</tr>
<tr>
<td><code>wsa:ReplyTo</code></td>
<td>Reply endpoint. If not specified, the reply endpoint defaults to <a href="http://www.w3.org/2005/08/addressing/anonymous">http://www.w3.org/2005/08/addressing/anonymous</a>.</td>
</tr>
<tr>
<td><code>wsa:FaultTo</code></td>
<td>Fault endpoint.</td>
</tr>
</tbody>
</table>
Example 10–1 shows a SOAP 1.2 request message sent over HTTP 1.2 with WS-Addressing enabled. As shown in bold, WS-Addressing provides a transport-neutral mechanism for defining a unique ID for the message (wsa:MessageID), the destination (wsa:To) endpoint, the reply endpoint (wsa:ReplyTo), and the required action (wsa:Action).

Table 10–1 (Cont.) WS-Addressing Message Addressing Properties

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>wsa:Action</td>
<td>Required action. This property is required when WS-Addressing is enabled. It can be implicitly or explicitly configured, as described in Section 10.4, &quot;Associating WS-Addressing Action Properties.&quot;</td>
</tr>
<tr>
<td>wsa:MessageID</td>
<td>Unique ID of the message.</td>
</tr>
<tr>
<td>wsa:RelatesTo</td>
<td>Message ID to which the message relates. This element can be repeated if there are multiple related messages. You can specify RelationshipType as an attribute of this property, which defaults to <a href="http://www.w3.org/2005/08/addressing/reply">http://www.w3.org/2005/08/addressing/reply</a>.</td>
</tr>
<tr>
<td>wsa:ReferenceParameters</td>
<td>Reference parameters that need to be communicated.</td>
</tr>
</tbody>
</table>

Example 10–1 SOAP 1.2 Message With WS-Addressing—Request Message

```xml
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
xmlns:wsa="http://www.w3.org/2005/08/addressing/">
  <S:Header>
    <wsa:MessageID>http://example.com/someuniquestring</wsa:MessageID>
    <wsa:ReplyTo>
      <wsa:Address>http://example.com/Myclient</wsa:Address>
    </wsa:ReplyTo>
    <wsa:To>http://example.com/fabrikam/Purchasing</wsa:To>
    <wsa:Action>http://example.com/fabrikam/SubmitPO</wsa:Action>
  </S:Header>
  <S:Body>
    ...
  </S:Body>
</S:Envelope>
```

A response to this message may appear as shown in Example 10–2. The RelatesTo property correlates the response message with the original request message.

Example 10–2 SOAP 1.2 Message Without WS-Addressing—Response Message

```xml
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
xmlns:wsa="http://www.w3.org/2005/08/addressing/">
  <S:Header>
    <wsa:MessageID>http://example.com/someotheruniquestring</wsa:MessageID>
    <wsa:RelatesTo>http://example.com/someotheruniquestring</wsa:RelatesTo>
    <wsa:To>http://example.com/MyClient</wsa:To>
  </S:Header>
</S:Envelope>
```
WS-Addressing is used by the following advanced WebLogic JAX-WS features:

- Asynchronous client transport, as described in Chapter 12, "Developing Asynchronous Clients".
- WS-ReliableMessaging, as described in Chapter 14, "Using Web Services Reliable Messaging".
- Callbacks, as described in Chapter 26, "Using Callbacks".

The following sections describe how to enable WS-Addressing on the web service or client, and explicitly define the action and fault properties.

### A Note About WS-Addressing Standards Supported

WebLogic web services support the following standards for web service addressing:

- W3C WS-Addressing, as described at: [http://www.w3.org/2002/ws/addr/](http://www.w3.org/2002/ws/addr/)
- Member Submission, as described at: [http://www.w3.org/Submission/ws-addressing/](http://www.w3.org/Submission/ws-addressing/)

This chapter focuses on the use of W3C WS-Addressing only.

### 10.2 Enabling WS-Addressing on the Web Service

By default, WS-Addressing is disabled on a web service endpoint, and any WS-Addressing headers received are ignored. You can enable WS-Addressing on the Web Service starting from Java or WSDL, as described in the following sections:

- Section 10.2.1, "Enabling WS-Addressing on the Web Service (Starting From Java)"
- Section 10.2.2, "Enabling WS-Addressing on the Web Service (Starting from WSDL)"

When you enable WS-Addressing on a web service endpoint:

- All WS-Addressing headers are understood by the endpoint. That is, if any WS-Addressing header is received with `mustUnderstand` enabled, then no fault is thrown.
- WS-Addressing headers received are validated to ensure:
  - Correct syntax
  - Correct number of elements
  - `wsa:Action` header in the SOAP header matches what is required by the operation
- Response messages returned to the client contain the required WS-Addressing headers.

### 10.2.1 Enabling WS-Addressing on the Web Service (Starting From Java)

To enable WS-Addressing on the web service starting from Java, use the `java.xml.ws.soap.Addressing` annotation on the web service class. Optionally, you
Enabling WS-Addressing on the Web Service

can pass one or more of the Boolean attributes defined in Table 10–2.

Table 10–2 Attributes of the @Addressing Annotation

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>enabled</td>
<td>Specifies whether WS-Addressing is enabled. Valid values include true (enabled) and false (disabled). This attribute defaults to true.</td>
</tr>
<tr>
<td>required</td>
<td>Specifies whether WS-Addressing rules are enforced for the inbound message. Valid values include true (enforced) and false (not enforced). If set to false, the inbound message is checked to see if WS-Addressing is enabled, and, if so, the rules are enforced. This attribute defaults to false.</td>
</tr>
</tbody>
</table>

Once enabled, the wsaw:UsingAddressing element is generated in the corresponding wsdl:binding element. For more information, see Section 10.2.2, "Enabling WS-Addressing on the Web Service (Starting from WSDL)."

The following provides an example of how to enable WS-Addressing starting from Java. In this example, WS-Addressing is enforced on the endpoint (required is set to true).

Example 10–3 Enabling WS-Addressing on the Web Service (Starting From Java)

```java
package examples;
import javax.jws.WebService;
import javax.xml.ws.soap.Addressing;
@WebService(name="HelloWorld", serviceName="HelloWorldService")
@Addressing(enabled=true, required=false)
public class HelloWorld {
    public String sayHelloWorld(String message) throws MissingName { ... }
}
```

10.2.2 Enabling WS-Addressing on the Web Service (Starting from WSDL)

To enable WS-Addressing on the web service starting from WSDL, add the wsaw:UsingAddressing element to the corresponding wsdl:binding element. Optionally, you can add the wsdl:required Boolean attribute to specify whether WS-Addressing rules are enforced for the inbound message. By default, this attribute is false.

The following provides an example of how to enable WS-Addressing starting from WSDL. In this example, WS-Addressing is enforced on the endpoint (wsdl:required is set to true).

Example 10–4 Enabling WS-Addressing on the Web Service (Starting From WSDL)

```xml
...<binding name="HelloWorldPortBinding" type="tns:HelloWorld">
    <wsaw:UsingAddressing wsdl:required="true" />
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="document"/>
    <operation name="sayHelloWorld">
        <soap:operation soapAction=""/>
        <input>
            <soap:body use="literal"/>
```
10.3 Enabling WS-Addressing on the Web Service Client

WS-Addressing can be enabled on the web service client implicitly or explicitly. Once enabled on the client:

- All WS-Addressing headers received on the client are understood. That is, if any WS-Addressing header is received with mustUnderstand enabled, then no fault is thrown.
- The JAX-WS runtime:
  - Generates Action, To, MessageID, and anonymous ReplyTo headers on the outbound request.

The following sections describe how to enable WS-Addressing on the web service client explicitly and implicitly, and how to disable WS-Addressing explicitly.

- Section 10.3.1, "Explicitly Enabling WS-Addressing on the Web Service Client"
- Section 10.3.2, "Implicitly Enabling WS-Addressing on the Web Service Client"
- Section 10.3.3, "Disabling WS-Addressing on the Web Service Client"

10.3.1 Explicitly Enabling WS-Addressing on the Web Service Client

The web service client can enable WS-Addressing explicitly by passing javax.xml.ws.soap.AddressingFeature as an argument to the getPort or createDispatch methods on the javax.xml.ws.Service object. Optionally, you can pass one or more of the Boolean parameters defined in Table 10–3.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>enabled</td>
<td>Specifies whether WS-Addressing is enabled for an outbound message. Valid values include true (enabled) and false (disabled). This attribute defaults to true.</td>
</tr>
<tr>
<td>required</td>
<td>Specifies whether WS-Addressing rules are enforced for the inbound messages. Valid values include true (enforced) and false (not enforced). If set to false, the inbound message is checked to see if WS-Addressing is enabled, and, if so, the rules are enforced. This attribute defaults to false.</td>
</tr>
</tbody>
</table>
The following shows an example of enabling WS-Addressing on a web service client when creating a web service proxy, by passing the `AddressingFeature` to the `getPort` method.

**Example 10–5  Enabling WS-Addressing on a Web Service Client on the Web Service Proxy**

```java
package examples.client;

import javax.xml.namespace.QName;
import java.net.MalformedURLException;
import java.net.URL;
import examples.client.MissingName_Exception;
import javax.xml.ws.soap.AddressingFeature;

public class Main {
    public static void main(String[] args) throws MissingName_Exception {
        HelloWorldService service;
        try {
            service = new HelloWorldService(new URL(args[0] + "?WSDL"),
                    new QName("http://examples/", "HelloWorldService") );
        } catch (MalformedURLException murl) { throw new RuntimeException(murl); }

        HelloWorld port = service.getHelloWorldPort(
                    new AddressingFeature(true, true));
        ...
    }
}
```

The following shows an example of enabling WS-Addressing on a web service client when creating a Dispatch instance, by passing the `AddressingFeature` to the `createDispatch` method.

**Example 10–6  Enabling WS-Addressing on a Web Service Client on the Dispatch Instance**

```java
...
    HelloWorld port = service.getHelloWorldPort(new AddressingFeature(true));
    ...
```

### 10.3.2 Implicitly Enabling WS-Addressing on the Web Service Client

WS-Addressing is enabled implicitly if the `wsaw:UsingAddressing` extensibility element exists in the WSDL. For more information, see Section 10.2.2, "Enabling WS-Addressing on the Web Service (Starting from WSDL)."

### 10.3.3 Disabling WS-Addressing on the Web Service Client

A web service client may need to disable WS-Addressing processing explicitly, for example, if it has its own WS-Addressing processing module. For example, a Dispatch client in MESSAGE mode may be used to perform non-anonymous ReplyTo and FaultTo processing.

The following shows an example of how to disable explicitly WS-Addressing on a web service client when creating a web service proxy. In this example, the `AddressingFeature` feature is called with `enabled` set to `false`.

```java
```
Example 10–7  Disabling WS-Addressing on a Web Service Client
...
new AddNumbersImplService().getAddNumbersImplPort(new javax.xml.ws.AddressingFeature(false));
...

10.4 Associating WS-Addressing Action Properties

WS-Addressing defines an attribute, wsaw:Action, that can be used to explicitly associate WS-Addressing action message addressing properties with the web service. By default, an implicit action association is made when WS-Addressing is enabled and no action is explicitly associated with the web service.

The following sections describe how to associate WS-Addressing Action properties either explicitly or implicitly:

- Section 10.4.1, "Explicitly Associating WS-Addressing Action Properties (Starting from Java)"
- Section 10.4.2, "Explicitly Associating WS-Addressing Action Properties (Starting from WSDL)"
- Section 10.4.3, "Implicitly Associating WS-Addressing Action Properties"

10.4.1 Explicitly Associating WS-Addressing Action Properties (Starting from Java)

To explicitly associate WS-Addressing action properties with the web service starting from Java, use the javax.xml.ws.Action and javax.xml.ws.FaultAction annotations.

Optionally, you can pass to the @Action annotation one or more of the attributes defined in Table 10–4.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>input</td>
<td>Associates Action message addressing property for the input message of the operation.</td>
</tr>
<tr>
<td>output</td>
<td>Associates Action message addressing property for the output message of the operation.</td>
</tr>
<tr>
<td>fault</td>
<td>Associates Action message addressing property for the fault message of the operation. Each exception that is mapped to a SOAP fault and requires explicit association must be specified using the @FaultAction annotation, as described in Table 10–5.</td>
</tr>
</tbody>
</table>

You can pass to the @FaultAction annotation one or more of the attributes defined in Table 10–5.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>className</td>
<td>Name of the exception class. This attribute is required.</td>
</tr>
<tr>
<td>value</td>
<td>Value of the WS-Addressing Action message addressing property for the exception.</td>
</tr>
</tbody>
</table>

Once you explicitly associate the WS-Addressing action properties, the wsaw:Action attribute is generated in the corresponding input, output, and fault elements in the
Associating WS-Addressing Action Properties

wsdl:portType element. For more information, see Section 10.2.2, "Enabling WS-Addressing on the Web Service (Starting from WSDL)."

The following provides an example of how to explicitly associate the WS-Addressing action message addressing properties for the input, output, and fault messages on the sayHelloWorld method, using the @Action and @FaultAction annotations.

**Example 10–8  Example of Explicitly Associating an Action (Starting from Java)**

```java
@Action(
   input = "http://examples/HelloWorld/sayHelloWorldRequest",
   output = "http://examples/HelloWorld/sayHelloWorldResponse",
   fault = { @FaultAction(className = MissingName.class,
                      value = "http://examples/MissingNameFault")})

public String sayHelloWorld(String message) throws MissingName {
   ...
```

Once defined, the wsaw:Action element is generated in the corresponding input, output, and fault elements of the wsdl:operation element for the endpoint. For more information about these elements, see Section 10.4.2, "Explicitly Associating WS-Addressing Action Properties (Starting from WSDL)."

### 10.4.2  Explicitly Associating WS-Addressing Action Properties (Starting from WSDL)

To explicitly associate WS-Addressing action properties with the web service starting from WSDL, add the wsaw:Action element to the corresponding wsdl:binding element. Optionally, you can add the wsdl:required Boolean attribute to specify whether WS-Addressing rules are enforced for the inbound message. By default, this attribute is false.

The following provides an example of how to, within the WSDL file, explicitly associate the WS-Addressing action message addressing properties for the input, output, and fault messages on the sayHelloWorld method of the HelloWorld endpoint.

**Example 10–9  Example of Explicitly Associating an Action (Starting from WSDL)**

```xml
<portType name="HelloWorld">
   <operation name="sayHelloWorld">
      <input wsaw:Action="http://examples/HelloWorld/sayHelloWorldRequest" message="tns:sayHelloWorld"/>
      <fault message="tns:MissingName" name="MissingName" wsaw:Action="http://examples/MissingNameFault"/>
   </operation>
</portType>
```

### 10.4.3  Implicitly Associating WS-Addressing Action Properties

When WS-Addressing is enabled, if no explicit action is defined in the WSDL, the client sends an implicit wsa:Action header using the following formats:

- **Input message action:** targetNamespace/portTypeName/inputName
Output message action: targetNamespace/portTypeName/outputName

Fault message action: targetNamespace/portTypeName/operationName/Fault/FaultName

targetNamespace/portTypeName/[inputName | outputName]

For example, for the following WSDL excerpt:

```xml
<definitions targetNamespace="http://examples/"...>
...
<portType name="HelloWorld">
  <operation name="sayHelloWorld">
    <input message="tns:sayHelloWorld" name="sayHelloRequest"/>
    <output message="tns:sayHelloWorldResponse" name="sayHelloResponse"/>
    <fault message="tns:MissingName" name="MissingName"/>
  </operation>
</portType>
...
</definitions>
```

The default input and output actions would be defined as follows:

- **Input message action:** http://examples/HelloWorld/sayHelloRequest
- **Output message action:** http://examples/HelloWorld/sayHelloResponse
- **Fault message action:** http://examples/HelloWorld/sayHelloWorld/Fault/MissingName

If the input or output message name is not specified in the WSDL, the operation name is used with Request or Response appended, respectively. For example: sayHelloWorldRequest or sayHelloWorldResponse.

### 10.5 Configuring Anonymous WS-Addressing

In some cases, the network technologies used in an environment (such as, firewalls, Dynamic Host Configuration Protocol (DHCP), and so on) may prohibit the use of globally addressed URI for a given endpoint. To enable non-addressable endpoints to exchange messages, the WS-Addressing specification supports "anonymous" endpoints using the `wsaw:Anonymous` element.

The `wsaw:Anonymous` element can be set to one of the values defined in **Table 10–6**.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>optional</td>
<td>The response endpoint EPR in a request message may contain an anonymous URI.</td>
</tr>
<tr>
<td>required</td>
<td>The response endpoint EPR in a request message must contain an anonymous URL. Otherwise, an <code>InvalidAddressingHeader</code> fault is returned.</td>
</tr>
<tr>
<td>prohibited</td>
<td>The response endpoint EPRs in a request message must not contain an anonymous URL. Otherwise, an <code>InvalidAddressingHeader</code> fault is returned.</td>
</tr>
</tbody>
</table>

To configure anonymous WS-Addressing:
1. Enable WS-Addressing on the web service, add the `wsaw:UsingAddressing` element to the corresponding `wsdl:binding` element. For more information, see Section 10.2.2, "Enabling WS-Addressing on the Web Service (Starting from WSDL)."

**Note:** When anonymous WS-Addressing is enabled, the `wsdl:required` attribute must not be enabled in the `wsaw:UsingAddressing` element.

2. Add the `wsaw:Anonymous` element to the `wsdl:operation` within the `wsdl:binding` element.

The following provides an example of how to enable anonymous WS-Addressing in the WSDL file. In this example, anonymous addressing is required.

**Example 10–10   Enabling Anonymous WS-Addressing on the Web Service**

```xml
...<binding name="HelloWorldPortBinding" type="tns:HelloWorld">
  <wsaw:UsingAddressing wsdl:required="true" />
  <soap:binding transport="http://schemas.xmlsoap.org/soap/http"
                 style="document"/>
  <operation name="sayHelloWorld">
    <soap:operation soapAction=""/>
    <input>
      <soap:body use="literal"/>
    </input>
    <output>
      <soap:body use="literal"/>
    </output>
    <fault name="MissingName">
      <soap:fault name="MissingName" use="literal"/>
    </fault>
  </operation>
  <wsaw:Anonymous>required</wsaw:Anonymous>
</binding>...
```
This chapter presents best practices for developing asynchronous WebLogic web service clients for Java API for XML Web Services (JAX-WS).

Table 11–1 provides best practices for developing asynchronous web service clients, and is followed by an example that illustrates the best practices presented. These guidelines should be used in conjunction with the general guidelines provided in Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients."

For best practices when developing reliable web service clients, see Chapter 13, "Roadmap for Developing Reliable Web Services and Clients."

---

**Note:** In the following table, *client instance* can be a port or a Dispatch instance.
The following example illustrates best practices for developing asynchronous web service clients.

**Example 11–1  Asynchronous Web Service Client Best Practices Example**

```java
import java.io.*;
import java.util.*;
import javax.servlet.*;
import javax.xml.ws.*;
import weblogic.jws.jaxws.client.ClientIdentityFeature;
import weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature;
import weblogic.jws.jaxws.client.async.AsyncClientTransportFeature;
import com.sun.xml.ws.developer.JAXWSProperties;
```

### Table 11–1  Roadmap for Developing Asynchronous Web Service Clients

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define a port-based asynchronous callback handler, AsyncClientHandlerFeature, for asynchronous and dispatch callback handling.</td>
<td>Use of AsyncClientHandlerFeature is recommended as a best practice when using asynchronous invocation due to its scalability and ability to survive a JVM restart. It can be used by any client (survivable or not.) For information, see Section 12.5.2, &quot;Developing the Asynchronous Handler Interface&quot;.</td>
</tr>
</tbody>
</table>
| Define a singleton port instance and initialize it when the client container initializes (upon deployment). | Creation of the singleton port:  
- Triggers the asynchronous response endpoint to be published upon deployment.  
- Supports failure recovery by re-initializing the singleton port instance after VM restart.  
Within a cluster, initialization of a singleton port will ensure that all member servers in the cluster publish an asynchronous response endpoint. This ensures that the asynchronous response messages can be delivered to any member server and optionally forwarded to the correct server via in-place cluster routing. For complete details, see Section 12.10, "Clustering Considerations for Asynchronous Web Service Messaging". |
| If using Make Connection for clients behind a firewall, set the Make Connection polling interval to a value that is realistic for your scenario. | The Make Connection polling interval should be set as high as possible to avoid unnecessary polling overhead, but also low enough to allow responses to be retrieved in a timely fashion. A recommended value for the Make Connection polling interval is one-half of the expected average response time of the web service being invoked. For more information setting the Make Connection polling interval, see Section 12.6.2.2, "Configuring the Polling Interval."  
*Note:* This best practice is not demonstrated in Example 11–1. |
| If using the JAX-WS Reference Implementation (RI), implement the AsyncHandler<T> interface. | Use of the AsyncHandler<T> interface is more efficient than the Response<T> interface. For more information and an example, see Section 12.7, "Using the JAX-WS Reference Implementation".  
*Note:* This best practice is not demonstrated in Example 11–1. |
| Define a Work Manager and set the thread pool minimum size constraint (min-threads-constraint) to a value that is at least as large as the expected number of concurrent requests or responses into the service. | For example, if a web service client issues 20 requests in rapid succession, the recommended thread pool minimum size constraint value would be 20 for the application hosting the client. If the configured constraint value is too small, performance can be severely degraded as incoming work waits for a free processing thread.  
For more information about the thread pool minimum size constraint, see "Constraints" in Administering Server Environments for Oracle WebLogic Server. |

The following example illustrates best practices for developing asynchronous web service clients.
/**
 * Example client for invoking a web service asynchronously.
 */
public class BestPracticeAsyncClient
extends GenericServlet {

private static final String MYPROPERTY = "MyProperty";
private BackendServiceService _service;
private WebServiceFeature[] _features;
private BackendService _singletonPort;

private static String _lastResponse;
private static int _requestCount;

@Override
public void init() throws ServletException {
    // Only create the web service object once as it is expensive to create repeatedly.
    if (_service == null) {
        _service = new BackendServiceService();
    }

    // Best Practice: Use a stored list of features, including client ID, to create client
    // instances.
    // Define all features for the web service client instance, including client ID, so that they
    // are consistent each time the client instance is created. For example:
    // _service.getBackendServicePort(_features);

    List<WebServiceFeature> features = new ArrayList<WebServiceFeature>();

    // Best Practice: Explicitly define the client ID.
    ClientIdentityFeature clientIdFeature =
        new ClientIdentityFeature("MyBackendServiceAsyncClient");
    features.add(clientIdFeature);

    // Asynchronous endpoint
    AsyncClientTransportFeature asyncFeature =
        new AsyncClientTransportFeature(getServletContext());
    features.add(asyncFeature);

    // Best Practice: Define a port-based asynchronous callback handler,
    // AsyncClientHandlerFeature, for asynchronous and dispatch callback handling.
    BackendServiceAsyncHandler handler =
        new BackendServiceAsyncHandler() {
            // This class is stateless and should not depend on
            // having member variables to work with across restarts.
            public void onDoSomethingResponse(Response<DoSomethingResponse> res) {
                // ... Handle Response ...
                try {
                    DoSomethingResponse response = res.get();
                    res.getContext();
                    _lastResponse = response.getReturn();
                    System.out.println("Got async response: " + _lastResponse);
                    // Retrieve the request property. This property can be used to
                    // 'remember' the context of the request and subsequently process
                    // the response.
                    Map<String, Serializable> requestProps =
(Map<String, Serializable>)
res.getContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
String myProperty = (String)requestProps.get(MY_PROPERTY);
System.out.println("Got MyProperty value propagated from request: "+
myProperty);
} catch (Exception e) {
  _lastResponse = e.toString();
e.printStackTrace();
}
};
AsyncClientHandlerFeature handlerFeature =
new AsyncClientHandlerFeature(handler);
features.add(handlerFeature);

// Set the features used when creating clients with
// the client ID "MyBackendServiceAsyncClient".

_features = features.toArray(new WebServiceFeature[features.size()]);

// Best Practice: Define a singleton port instance and initialize it when
// the client container initializes (upon deployment).
// The singleton port will be available for the life of the servlet.
// Creation of the singleton port triggers the asynchronous response endpoint to be published
// and it will remain published until our container (Web application) is undeployed.
// Note, the destroy() method will be called before this.
// The singleton port ensures proper/robust operation in both
// recovery and clustered scenarios.
_singletonPort = _service.getBackendServicePort(_features);
}

@Override
public void service(ServletRequest req, ServletResponse res)
throws ServletException, IOException {

// TODO: ... Read the servlet request ...

// For this simple example, echo the _lastResponse captured from
// an asynchronous DoSomethingResponse response message.

if (_lastResponse != null) {
  res.getWriter().write(_lastResponse);
  _lastResponse = null; // Clear the response so we can get another
  return;
}

// Set _lastResponse to NULL to to support the invocation against
// BackendService to generate a new response.

// Best Practice: Synchronize use of client instances.
// Create another client instance using the "exact" same features used when creating _
// singletonPort. Note, this port uses the same client ID as the singleton port
// and it is effectively the same as the singleton
// from the perspective of the web services runtime.
// This port will use the asynchronous response endpoint for the client ID,
// as it is defined in the _features list.
BackendService anotherPort =
_service.getBackendServicePort(_features);

// Set the endpoint address for BackendService.
((BindingProvider)anotherPort).getRequestContext().put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY, "http://localhost:7001/BestPracticeService/BackendService");

// Add a persistent context property that will be retrieved on the // response. This property can be used as a reminder of the context of this // request and subsequently process the response. This property will *not* // be passed over the wire, so the properties can change independent of the // application message.
Map<String, Serializable> persistentContext = ((Map<String, Serializable>)(BindingProvider)anotherPort).getRequestContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
String myProperty = "Request " + (++_requestCount);
persistentContext.put(MY_PROPERTY, myProperty);
System.out.println("Request being made with MyProperty value: " + myProperty);

// Make the asynchronous invocation. The asynchronous handler implementation (set // into the AsyncClientHandlerFeature above) receives the response.
String request = "Dance and sing";
System.out.println("Invoking DoSomething asynchronously with request: " + request);
anotherPort.doSomethingAsync(request);

// Return a canned string indicating the response was not received // synchronously. Client will need to invoke the servlet again to get // the response.
res.getWriter().write("Waiting for response...");

// Best Practice: Explicitly close client instances when processing is complete. // If not closed explicitly, the port will be closed automatically when it goes out of scope.
((java.io.Closeable)anotherPort).close();

@override
public void destroy() {
 try {
 // Best Practice: Explicitly close client instances when processing is complete.
 // Close the singleton port created during initialization. Note, the asynchronous // response endpoint generated by creating _singletonPort *remains* // published until our container (Web application) is undeployed.
 ((java.io.Closeable)_singletonPort).close();

 // Upon return, the Web application is undeployed, and the asynchronous // response endpoint is stopped (unpublished). At this point, // the client ID used for _singletonPort will be unregistered and will no longer be // visible from the Administration Console and WLST.
 } catch (Exception e) {
 e.printStackTrace();
 }
}
}
Developing Asynchronous Clients

This chapter describes how to develop asynchronous WebLogic web service clients using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 12.1, "Overview of Asynchronous Web Service Invocation"
- Section 12.2, "Steps to Invoke Web Services Asynchronously"
- Section 12.3, "Configuring Your Servers for Asynchronous Web Service Invocation"
- Section 12.4, "Building the Client Artifacts for Asynchronous Web Service Invocation"
- Section 12.5, "Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)"
- Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)"
- Section 12.7, "Using the JAX-WS Reference Implementation"
- Section 12.8, "Propagating Request Context to the Response"
- Section 12.9, "Monitoring Asynchronous Web Service Invocation"
- Section 12.10, "Clustering Considerations for Asynchronous Web Service Messaging"

**Note:** See also Chapter 11, "Roadmap for Developing Asynchronous Web Service Clients."

### 12.1 Overview of Asynchronous Web Service Invocation

To support asynchronous web services invocation, WebLogic web services can use an asynchronous client programming model, asynchronous transport, or both.

Table 12–1 provides a description and key benefits of the asynchronous client programming model and transport types, and introduces the configuration options available to support asynchronous web service invocation.

**Note:** The method of generating a WSDL for the asynchronous web service containing two one-way operations defined as two portTypes—one for the asynchronous operation and one for the callback operation—is not supported in the current release.
Table 12–1  Support for Asynchronous Web Service Invocation

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client programming model</td>
<td>Describes the invocation semantics used to call a web service operation: synchronous or asynchronous.</td>
<td>Asynchronous invocation enables web service clients to initiate a request to a web service, continue processing without blocking, and receive the response at some point in the future.</td>
</tr>
<tr>
<td></td>
<td>When you invoke a web service synchronously, the invoking client application waits for the response to return before it can continue with its work. In cases where the response returns immediately, this method of invoking the web service might be adequate. However, because request processing can be delayed, it is often useful for the client application to continue its work and handle the response later on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>By calling a web service asynchronously, the client can continue its processing, without interruption, and be notified when the asynchronous response is returned.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To support asynchronous invocation, you generate automatically an asynchronous flavor of each operation on a web service port using the clientgen Ant task, as described later in Section 12.4, &quot;Building the Client Artifacts for Asynchronous Web Service Invocation.&quot; Then, you add methods in your client, including your business logic, that handle the asynchronous response or failures when it returns later on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finally, to invoke a web service asynchronously, rather than invoking the operation directly, you invoke the asynchronous flavor of the operation. For example, rather than invoking an operation called addNumbers directly, you would invoke addNumbersAsync instead.</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>There are three transport types: asynchronous client transport, Make Connection transport, and synchronous transport. For a comparison of each transport type, see Table 12–2.</td>
<td>Asynchronous client transport and Make Connection transport deliver the following key benefits:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Improves fault tolerance in the event of network outages.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Enables servers to absorb more efficiently spikes in traffic.</td>
</tr>
<tr>
<td>Configuration</td>
<td>Configure web service persistence and buffering (optional) to support asynchronous web service invocation.</td>
<td>Benefits of configuring the web service features include:</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.3, &quot;Configuring Your Servers for Asynchronous Web Service Invocation.&quot;</td>
<td>■ Persistence supports long running requests and provides the ability to survive server restarts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Buffering enables all requests to a web service to be handled asynchronously.</td>
</tr>
</tbody>
</table>

Table 12–2 summarizes the transport types that WebLogic Server supports for invoking a web service asynchronously (or synchronously, if configured) from a web service client.
### Table 12–2 Transport Types for Invoking Web Services Asynchronously

<table>
<thead>
<tr>
<th>Transport Types</th>
<th>Description</th>
</tr>
</thead>
</table>
| Asynchronous Client Transport    | Provides a scalable asynchronous client programming model through the use of an *addressable* client-side asynchronous response endpoint and WS-Addressing. Asynchronous client transport decouples the delivery of the response message from the initiating transport request used to send the request message. The response message is sent to the asynchronous response endpoint using a new connection originating from the web service. The client correlates request and response messages through WS-Addressing headers. Asynchronous client transport provides improved fault tolerance and enables servers to better absorb spikes in server load. For details about using asynchronous client transport, see Section 12.5, "Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)." Asynchronous client transport supports the following programming models:  
- Asynchronous and dispatch callback handling using one of the following methods:  
  - Port-based asynchronous callback handler, AsyncClientHandlerFeature, described in Section 12.5.2, "Developing the Asynchronous Handler Interface." This is recommended as a best practice when using asynchronous invocation due to its scalability and ability to survive a JVM restart.  
  - Per-request asynchronous callback handler, as described in Section 12.7, "Using the JAX-WS Reference Implementation."  
- Asynchronous polling, as described in Section 12.7, "Using the JAX-WS Reference Implementation."  
- Synchronous invocation by enabling a flag, as described in Section 12.5.1.5, "Configuring Asynchronous Client Transport for Synchronous Operations." |
Overview of Asynchronous Web Service Invocation

Developing Asynchronous Clients

Make Connection Transport Enables asynchronous web service invocation from behind a firewall using Web Services Make Connection 1.1 or 1.0. Make Connection is a client polling mechanism that provides an alternative to asynchronous client transport. As with asynchronous client transport, Make Connection enables the decoupling of the response message from the initiating transport request used to send the request message. However, unlike asynchronous client transport which requires an addressable asynchronous response endpoint to forward the response to, with Make Connection typically the sender of the request message is non-addressable and unable to accept an incoming connection. For example, when the sender is located behind a firewall.

Make Connection transport provides improved fault tolerance and enables servers to better absorb spikes in server load.

For details about Make Connection transport, see Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)."

Make Connection transport is recommended as a best practice when using asynchronous invocation from behind a firewall due to its scalability and ability to survive a JVM restart. It supports the following programming models:

- Asynchronous and dispatch callback handling using one of the following methods:
  - Port-based asynchronous callback handler, AsyncClientHandlerFeature, described in Section 12.5.2, "Developing the Asynchronous Handler Interface".
  - Per-request asynchronous callback handler, as described in Section 12.7, "Using the JAX-WS Reference Implementation".

- Asynchronous polling, as described in Section 12.7, "Using the JAX-WS Reference Implementation".

- Synchronous invocation by enabling a flag, as described in Section 12.6.2.4, "Configuring Make Connection as the Transport for Synchronous Methods".

Use of Make Connection transport with AsyncClientHandlerFeature is recommended as a best practice when using asynchronous invocation due to its scalability and ability to survive a JVM restart.

Synchronous Transport Provides support for synchronous and asynchronous web service invocation with very limited support for WS-Addressing. For details, see Section 12.7, "Using the JAX-WS Reference Implementation".

Synchronous transport is recommended when using synchronous invocation. It can be used for asynchronous invocation, as well, though this is not considered a best practice. It supports the following programming models:

- Asynchronous and dispatch callback handling on a per request basis using the standard JAX-WS RI implementation, described in Section 12.7, "Using the JAX-WS Reference Implementation".

- Asynchronous polling, as described in Section 12.7, "Using the JAX-WS Reference Implementation".

- Synchronous invocation.

<table>
<thead>
<tr>
<th>Transport Types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make Connection Transport</td>
<td>Enables asynchronous web service invocation from behind a firewall using Web Services Make Connection 1.1 or 1.0. Make Connection is a client polling mechanism that provides an alternative to asynchronous client transport. As with asynchronous client transport, Make Connection enables the decoupling of the response message from the initiating transport request used to send the request message. However, unlike asynchronous client transport which requires an addressable asynchronous response endpoint to forward the response to, with Make Connection typically the sender of the request message is non-addressable and unable to accept an incoming connection. For example, when the sender is located behind a firewall. Make Connection transport provides improved fault tolerance and enables servers to better absorb spikes in server load. For details about Make Connection transport, see Section 12.6, &quot;Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection).&quot; Make Connection transport is recommended as a best practice when using asynchronous invocation from behind a firewall due to its scalability and ability to survive a JVM restart. It supports the following programming models: - Asynchronous and dispatch callback handling using one of the following methods: - Port-based asynchronous callback handler, AsyncClientHandlerFeature, described in Section 12.5.2, &quot;Developing the Asynchronous Handler Interface&quot;. - Per-request asynchronous callback handler, as described in Section 12.7, &quot;Using the JAX-WS Reference Implementation&quot;. - Asynchronous polling, as described in Section 12.7, &quot;Using the JAX-WS Reference Implementation&quot;. - Synchronous invocation by enabling a flag, as described in Section 12.6.2.4, &quot;Configuring Make Connection as the Transport for Synchronous Methods&quot;. Use of Make Connection transport with AsyncClientHandlerFeature is recommended as a best practice when using asynchronous invocation due to its scalability and ability to survive a JVM restart.</td>
</tr>
</tbody>
</table>
12.2 Steps to Invoke Web Services Asynchronously

This section describes the steps required to invoke web services asynchronously.

It is assumed that you have set up an Ant-based development environment and that you have a working build.xml file to which you can add targets for running the jwsc Ant task and deploying the web services. For more information, see Chapter 3, "Developing JAX-WS Web Services."

Table 12–3 Steps to Invoke Web Services Asynchronously

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Configure web service persistence to support asynchronous web service invocation.</td>
<td>Configure web service persistence on the servers hosting the web service and client to retain context information required for processing a message at the web service or client. For more information, see Section 12.3, &quot;Configuring Your Servers for Asynchronous Web Service Invocation&quot;. <strong>Note:</strong> This step is not required if you are programming the web service client using the standard JAX-WS RI implementation and synchronous transport (in Step 3), as described in Section 12.7, &quot;Using the JAX-WS Reference Implementation&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>Configure web service buffering to enable the web service to process requests asynchronously. (Optional)</td>
<td>This step is optional. To configure the web service to process requests asynchronously, configure buffering on the server hosting the web service. Buffering enables you to store messages in a JMS queue for asynchronous processing by the web service. For more information, see Section 12.3, &quot;Configuring Your Servers for Asynchronous Web Service Invocation&quot;.</td>
</tr>
<tr>
<td>3</td>
<td>Build the client artifacts required for asynchronous invocation.</td>
<td>To generate asynchronous polling and asynchronous callback handler methods in the service endpoint interface, create an external binding declarations that enables asynchronous mappings and pass the bindings file as an argument to the clientgen when compiling the client. See Section 12.4, &quot;Building the Client Artifacts for Asynchronous Web Service Invocation&quot;.</td>
</tr>
</tbody>
</table>
| 4  | Implement the web service client based on the transport and programming model required. | Refer to one of the following sections based on the transport and programming model required:  
- Use asynchronous client transport, as described in Section 12.5, "Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)". (Recommended as a best practice.)  
- Enable asynchronous access from behind a firewall using Make Connection. See Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)".  
- Implement standard JAX-WS programming models, such as asynchronous polling or per-request asynchronous callback handling, using synchronous transport. See Section 12.7, “Using the JAX-WS Reference Implementation”.  
When using web services in a cluster, review the guidelines described in Section 12.10, "Clustering Considerations for Asynchronous Web Service Messaging". |
| 5  | Compile the web service client and package the client artifacts. | For more information, see Section 8.2.4, "Compiling and Running the Client Application.” |
| 6  | Deploy the web service client. | See Section 3.9, "Deploying and Undeploying WebLogic Web Services.” |
12.3 Configuring Your Servers for Asynchronous Web Service Invocation

To support asynchronous web service invocation, you need to configure the features defined in the following table on the servers to which the web service and client are deployed.

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Monitor the web service client.</td>
<td>You can monitor runtime information for clients that invoke web services asynchronously, such as number of invocations, errors, faults, and so on, using the WebLogic Server Administration Console or WLST. See Section 12.9, &quot;Monitoring Asynchronous Web Service Invocation&quot;.</td>
</tr>
</tbody>
</table>

Note: This step is not required if you are programming the web service client using the standard JAX-WS RI implementation and synchronous transport, as described in Section 12.7, "Using the JAX-WS Reference Implementation".
Using the WebLogic Server client-side tooling (for example, clientgen), you can generate automatically the client artifacts required for asynchronous web service invocation. Specifically, the following artifacts are generated:

- Service endpoint interfaces for invoking the web service asynchronously with or without a per-request asynchronous callback handler. For example, if the web service defined the following method:

  ```java
  public int addNumbers(int opA, int opB) throws MyException
  ```

  Then the following methods will be generated:

  ```java
  public Future<?> addNumbersAsync(int opA, int opB,
  ```
StringBuilder<AddNumbersResponse>)
public Response<AddNumbersResponse> addNumbersAsync(int opA, int opB)

- Asynchronous handler interface for implementing a handler and setting it on the port using AsyncClientHandlerFeature. The asynchronous handler interface is named as follows: portInterfaceNameAsyncHandler, where portInterfaceName specifies the name of the port interface.

For example, for a web service with a port type name AddNumbersPortType, an asynchronous handler interface named AddNumbersPortTypeAsyncHandler is generated with the following method:

public void onAddNumbersResponse(Response<AddNumbersResponse>)

The AsyncClientHandlerFeature is described later, in Section 12.5.2, "Developing the Asynchronous Handler Interface".

To generate asynchronous client artifacts in the service endpoint interface when the WSDL is compiled, enable the jaxws:enableAsyncMapping binding declaration in the WSDL file.

Alternatively, you can create an external binding declarations file that contains all binding declarations for a specific WSDL or XML Schema document. Then, pass the binding declarations file to the <binding> child element of the wsdlc, jwsc, or clientgen Ant task. For more information, see Section 5.5.1.1, "Creating an External Binding Declarations File Using JAX-WS Binding Declarations."

The following provides an example of a binding declarations file (jaxws-binding.xml) that enables the jaxws:enableAsyncMapping binding declaration:

```xml
<bindings
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
    wsdlLocation="AddNumbers.wsdl"
    xmlns=http://java.sun.com/xml/ns/jaxws">
    <bindings node="wsdl:definitions">
        <package name="examples.webservices.async"/>
        <enableAsyncMapping>true</enableAsyncMapping>
    </bindings>
</bindings>
```

Then, to update the build.xml file to generate client artifacts necessary to invoke a web service operation asynchronously:

1. Use the taskdef Ant task to define the full classname of the clientgen Ant tasks.
2. Add a target that includes a reference to the external binding declarations file containing the asynchronous binding declaration, as defined above. In this case, the clientgen Ant task generates both synchronous and asynchronous flavors of the web service operations in the JAX-WS stubs.

For example:

```xml
<taskdef name='clientgen' 
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

<target name='build_client'>
    <clientgen
        type='JAXWS'
        wsdl='AddNumbers.wsdl'
        destDir='$(clientclasses.dir)'"
The asynchronous client transport feature provides a scalable asynchronous client programming model. Specifically, this feature:

- Publishes a client-side asynchronous response endpoint, shown in Figure 12–1.
- Creates and publishes a service implementation that invokes the requested asynchronous handler implementation.
- Automatically adds WS-Addressing non-anonymous ReplyTo headers to all non-one-way, outbound messages. This header references the published response endpoint.
- Correlates asynchronous request and response messages using the facilities listed above.

When the asynchronous client transport feature is enabled, all other JAX-WS client programming models (such as asynchronous polling, callback handler, dispatch, and so on) continue to be supported. Synchronous web service operations will, by default, use synchronous transport, unless explicitly configured to use asynchronous client transport feature when enabling the feature.

The following figure shows the message flow used by the asynchronous client transport feature.

**Figure 12–1 Asynchronous Client Transport Feature**

As shown in the previous figure:

1. The client enables the asynchronous client transport feature on the client proxy and invokes an asynchronous web service operation.
2. The web service operation is invoked via the client proxy.

3. The web service processes the request and sends a response message (at some time in the future) back to the client. The response message is sent to the client’s asynchronous response endpoint. The address of the asynchronous response endpoint is maintained in the WS-Addressing headers.

4. The response message is forwarded to the appropriate client via the client proxy.

5. The client asynchronous handler is invoked to handle the response message.

The following sections describe how to develop scalable asynchronous JAX-WS clients using asynchronous client transport:

- Section 12.5.1, "Enabling and Configuring the Asynchronous Client Transport Feature"
- Section 12.5.2, "Developing the Asynchronous Handler Interface"
- Section 12.5.3, "Propagating User-defined Request Context to the Response"

### 12.5.1 Enabling and Configuring the Asynchronous Client Transport Feature

**Note:** The Make Connection and asynchronous client transport features are mutually exclusive. If you attempt to enable both features on the same web service client, an error is returned. For more information about Make Connection, see Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection).

To enable the asynchronous client transport feature on a client, pass an instance of `weblogic.jws.jaxws.client.async.AsyncClientTransportFeature` as a parameter when creating the web service proxy or dispatch.

The asynchronous response endpoint described by the `AsyncClientTransportFeature` is used by all client instances that share the same client ID and is in effect from the time the first client instance using the client ID is published. The asynchronous response endpoint remains published until the client ID is explicitly disposed or the container for the client is deactivated (for example, the host Web application or EJB is undeployed). For more information about managing the client ID, see Section 8.7, "Managing Client Identity."

The asynchronous response endpoint address is generated automatically using the following format:

http://contextAddress:port/context/targetPort-AsyncResponse

In the above:

- `contextAddress:port`—Specifies one of the following:
  - If clustered application, cluster address and port.
  - If not clustered application, default WebLogic Server address and port for the selected protocol.
  - If no default address is defined, first network channel address for the given protocol. For more information about network channels, see "Configuring Network Resources" in *Administering Server Environments for Oracle WebLogic Server.*
Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)

- **context**—Current servlet context, if running within an existing context. Otherwise, a new context named by the UUID and scoped to the application.
- **targetPort-AsyncResponse**—Port name of the service accessed by the client appended by "-AsyncResponse".

You can configure the asynchronous client transport feature, as described in the following sections:

- Section 12.5.1.1, "Configuring the Address of the Asynchronous Response Endpoint"
- Section 12.5.1.2, "Configuring the ReplyTo and FaultTo Headers of the Asynchronous Response Endpoint"
- Section 12.5.1.3, "Configuring the Context Path of the Asynchronous Response Endpoint"
- Section 12.5.1.4, "Publishing the Asynchronous Response Endpoint"
- Section 12.5.1.5, "Configuring Asynchronous Client Transport for Synchronous Operations"

For more information about the AsyncClientTransportFeature() constructor formats, see the Java API Reference for Oracle WebLogic Server.

### 12.5.1.1 Configuring the Address of the Asynchronous Response Endpoint

You can configure an address for the asynchronous response endpoint by passing it as an argument to the AsyncClientTransportFeature, as follows:

```java
String responseAddress = "http://myserver.com:7001/myReliableService/myClientCallback";
AsyncClientTransportFeature asyncFeature = new AsyncClientTransportFeature(responseAddress);
BackendService port = _service.getBackendServicePort(asyncFeature);
```

The specified address must be a legal address for the server or cluster (including the network channels or proxy addresses). Ephemeral ports are not supported. The specified context must be scoped within the current application or refer to an unused context; it cannot refer to a context that is scoped to another deployed application, otherwise an error is thrown.

The following tables summarizes the constructors that can be used to configure the address of the asynchronous response endpoint.
Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)

12.5.1.2 Configuring the ReplyTo and FaultTo Headers of the Asynchronous Response Endpoint

You can configure the address to use for all outgoing ReplyTo and FaultTo headers of type `javax.xml.ws.wsaddressing.W3CEndpointReference` for the asynchronous response endpoint by passing them as arguments to the `AsyncClientTransportFeature`.

For example, to configure only the ReplyTo header address:

```java
W3CEndpointReference replyToAddress = "http://myserver.com:7001/myReliableService/myClientCallback";
AsyncClientTransportFeature asyncFeature = new AsyncClientTransportFeature(replyToAddress);
BackendService port = _service.getBackendServicePort(asyncFeature);
```

To configure both the ReplyTo and FaultTo header addresses:

```java
W3CEndpointReference replyToAddress = "http://myserver.com:7001/myReliableService/myClientCallback";
W3CEndpointReference faultToAddress = "http://myserver.com:7001/myReliableService/FaultTo";
AsyncClientTransportFeature asyncFeature = new AsyncClientTransportFeature(replyToAddress, faultToAddress);
BackendService port = _service.getBackendServicePort(asyncFeature);
```

The following tables summarizes the constructors that can be used to configure the endpoint reference address for the outgoing ReplyTo and FaultTo headers.

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsyncClientTransportFeature(java.lang.String address)</td>
<td>Configures the address of the asynchronous response endpoint.</td>
</tr>
</tbody>
</table>
| AsyncClientTransportFeature(java.lang.String address, boolean doPublish) | Configures the following:  
  - Address of the asynchronous response endpoint.  
  - Whether to publish the endpoint at the specified address. For more information, see Section 12.5.1.4, "Publishing the Asynchronous Response Endpoint". |
| AsyncClientTransportFeature(java.lang.String address, boolean doPublish, boolean useAsyncWithSyncInvoke) | Configures the following:  
  - Address of the asynchronous response endpoint.  
  - Whether to publish the endpoint at the specified address. For more information, see Section 12.5.1.4, "Publishing the Asynchronous Response Endpoint".  
  - Whether to enable asynchronous client transport for synchronous operations. For more information, see Section 12.5.1.5, "Configuring Asynchronous Client Transport for Synchronous Operations". |
Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)

### Table 12–6  Constructors for Configuring the ReplyTo and FaultTo Headers

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo)</code></td>
<td>Configures the endpoint reference address for the outgoing ReplyTo headers.</td>
</tr>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo, boolean doPublish)</code></td>
<td>Configures the following:</td>
</tr>
<tr>
<td></td>
<td>- Endpoint reference address for the outgoing ReplyTo headers.</td>
</tr>
<tr>
<td></td>
<td>- Whether to publish the endpoint at the specified address.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.4, &quot;Publishing the Asynchronous Response Endpoint&quot;.</td>
</tr>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo, boolean doPublish, boolean useAsyncWithSyncInvoke)</code></td>
<td>Configures the following:</td>
</tr>
<tr>
<td></td>
<td>- Endpoint reference address for the outgoing ReplyTo headers.</td>
</tr>
<tr>
<td></td>
<td>- Whether to publish the endpoint at the specified address.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.4, &quot;Publishing the Asynchronous Response Endpoint&quot;.</td>
</tr>
<tr>
<td></td>
<td>- Whether to enable asynchronous client transport for synchronous operations.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.5, &quot;Configuring Asynchronous Client Transport for Synchronous Operations&quot;.</td>
</tr>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo, javax.xml.ws.wsaddressing.W3CEndpointReference faultTo)</code></td>
<td>Configures the endpoint reference address for the outgoing ReplyTo and FaultTo headers.</td>
</tr>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo, javax.xml.ws.wsaddressing.W3CEndpointReference faultTo, boolean doPublish)</code></td>
<td>Configures the following:</td>
</tr>
<tr>
<td></td>
<td>- Endpoint reference address for the outgoing ReplyTo and FaultTo headers.</td>
</tr>
<tr>
<td></td>
<td>- Whether to publish the endpoint at the specified address.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.4, &quot;Publishing the Asynchronous Response Endpoint&quot;.</td>
</tr>
<tr>
<td><code>AsyncClientTransportFeature(javax.xml.ws.wsaddressing.W3CEndpointReference replyTo, javax.xml.ws.wsaddressing.W3CEndpointReference faultTo, boolean doPublish, boolean useAsyncWithSyncInvoke)</code></td>
<td>Configures the following:</td>
</tr>
<tr>
<td></td>
<td>- Endpoint reference address for the outgoing ReplyTo and FaultTo headers.</td>
</tr>
<tr>
<td></td>
<td>- Whether to publish the endpoint at the specified address.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.4, &quot;Publishing the Asynchronous Response Endpoint&quot;.</td>
</tr>
<tr>
<td></td>
<td>- Whether to enable asynchronous client transport for synchronous operations.</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 12.5.1.5, &quot;Configuring Asynchronous Client Transport for Synchronous Operations&quot;.</td>
</tr>
</tbody>
</table>

#### 12.5.1.3 Configuring the Context Path of the Asynchronous Response Endpoint

When a client is running within a servlet or Web application-based web service, it can use its ServletContext and context path to construct the asynchronous response endpoint. You pass the information as an argument to the `AsyncClientTransportFeature`, as follows:

- When running inside a servlet:
  
  ```java
  AsyncClientTransportFeature asyncFeature = new AsyncClientTransportFeature(getServletContext());
  ```

- When running inside a web service or an EJB-based web service:
import com.sun.xml.ws.api.server.Container;
...
Container c = ContainerResolver.getInstance().getContainer();
ServletContext servletContext = c.getSPI(ServletContext.class);
AsyncClientTransportFeature asyncFeature =
    new AsyncClientTransportFeature(servletContext);

The specified context must be scoped within the current application or refer to an
unused context; it cannot refer to a context that is scoped to another deployed
application.

**Note:** When you use the empty constructor for
AsyncClientTransportFeature, the web services runtime attempts to
discover the container in which the current feature was instantiated
and publish the endpoint using any available container context.

The following tables summarizes the constructors that can be used to configure the
context path of the asynchronous response endpoint.

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsyncClientTransportFeature(java.lang.Object context)</td>
<td>Configures the context path of the asynchronous response endpoint.</td>
</tr>
</tbody>
</table>
| AsyncClientTransportFeature(java.lang.Object context, boolean useAsyncWithSyncInvoke) | Configures the following:
| | ■ Context path of the asynchronous response endpoint. |
| | ■ Whether to enable asynchronous client transport for synchronous operations. For more information, see Section 12.5.1.5, "Configuring Asynchronous Client Transport for Synchronous Operations". |

**12.5.1.4 Publishing the Asynchronous Response Endpoint**

You can configure whether to publish the asynchronous response endpoint by passing
the doPublish boolean value as an argument to AsyncClientTransportFeature() when configuring the following properties:

- Address of the asynchronous response endpoint. See Table 12–5.
- ReplyTo and FaultTo headers. See Table 12–6.
- Context path of the asynchronous response endpoint. See Table 12–7.

If doPublish is set to false, then the asynchronous response endpoint is not published
automatically, but WS-Addressing headers will be added to outbound non-one-way
messages. This scenario supports the following programming models:

- Asynchronous polling (with no attempt to access the Response object)
- Dispatch asynchronous polling (with no attempt to access the Response object)
- Dispatch one-way invocation
- Synchronous invocation using synchronous transport option (default)

For all other asynchronous programming models, the availability of a asynchronous
response endpoint is required and the web service client is responsible for publishing
it prior to making outbound requests if doPublish is set to false.
The following example configures the asynchronous response endpoint address and publishes the asynchronous response endpoint:

```java
String responseAddress = "http://localhost:7001/myReliableService/myReliableResponseEndpoint";
boolean doPublish = true;
AsyncClientTransportFeature asyncFeature =
    new AsyncClientTransportFeature(responseAddress, doPublish);
BackendService port = _service.getBackendServicePort(asyncFeature);
```

### 12.5.1.5 Configuring Asynchronous Client Transport for Synchronous Operations

You can enable or disable asynchronous client transport for synchronous operations using the `useAsyncWithSyncInvoke` boolean flag when configuring the following properties:

- Address of the asynchronous response endpoint. See Table 12–5.
- ReplyTo and FaultTo headers. See Table 12–6.
- Context path of the asynchronous response endpoint. See Table 12–7.

The following example configures the asynchronous response endpoint address and enables use of asynchronous client transport for synchronous operations:

```java
String responseAddress = "http://localhost:7001/myReliableService/myReliableResponseEndpoint";
boolean useAsyncWithSyncInvoke = true;
AsyncClientTransportFeature asyncFeature =
    new AsyncClientTransportFeature(responseAddress, useAsyncWithSyncInvoke);
BackendService port = _service.getBackendServicePort(asyncFeature);
```

### 12.5.2 Developing the Asynchronous Handler Interface

**Note:** If you set a single asynchronous handler instance on the port, as described in this section, and subsequently attempt to configure a per-request asynchronous handler, as described in Section 12.7, “Using the JAX-WS Reference Implementation”, then a runtime exception is returned.

As described in Section 12.4, “Building the Client Artifacts for Asynchronous Web Service Invocation”, the asynchronous handler interface, `weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature`, sets a single asynchronous handler instance on the port rather than on a per-request basis.

For example, when you build the client classes using clientgen, as described in Section 12.4, “Building the Client Artifacts for Asynchronous Web Service Invocation”, the asynchronous handler interface is generated, as shown below.

**Example 12–1  Example of the Asynchronous Handler Interface**

```java
import javax.xml.ws.Response;

/**
 * This class was generated by the JAX-WS RI.
 * Oracle JAX-WS 2.1.5
 * Generated source version: 2.1
 */
```
The asynchronous handler interface is generated as part of the same package as the port interface and represents the methods required to accept responses for any operation defined on the service. You can import and implement this interface in your client code to provide a way to receive and process asynchronous responses in a strongly-typed manner.

To set a single asynchronous handler instance on the port, pass an instance of the `weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature` as a parameter when creating the web service proxy or dispatch. You specify the name of the asynchronous handler that will be invoked when a response message is received.

The following example shows how to develop an asynchronous handler interface. The example demonstrates how to initialize the `AsyncClientHandlerFeature` to connect the asynchronous handler implementation to the port used to make invocations on the backend service. This example is excerpted from Example 11–1, "Asynchronous Web Service Client Best Practices Example".

**Example 12–2  Example of Developing the Asynchronous Handler Interface**

```java
import weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature;
...
BackendServiceAsyncHandler handler = new BackendServiceAsyncHandler() {
    public void onDoSomethingResponse(Response<DoSomethingResponse> res) {
        // ... Handle Response ...
        try {
            DoSomethingResponse response = res.get();
            _lastResponse = response.getReturn();
            System.out.println("Got async response: " + _lastResponse);
        } catch (Exception e) {
            _lastResponse = e.toString();
            e.printStackTrace();
        }
    }
};
AsyncClientHandlerFeature handlerFeature = new AsyncClientHandlerFeature(handler);
features.add(handlerFeature);
_features = features.toArray(new WebServiceFeature[features.size()]);
BackendService anotherPort = _service.getBackendServicePort(_features);
...
// Make the invocation. Our asynchronous handler implementation (set
// into the AsyncClientHandlerFeature above) receives the response.
String request = "Dance and sing";
System.out.println("Invoking DoSomething asynchronously with request: " + request);
anotherPort.doSomethingAsync(request);
```
12.5.3 Propagating User-defined Request Context to the Response

The `weblogic.wsee.jaxws.JAXWSProperties` API defines the following properties that enables users to propagate user-defined request context information to the response message, without relying on the asynchronous handler instance state.

The asynchronous handler instance may be created at any time; for example, if the client's server goes down and is restarted. Therefore, storing request context in the asynchronous handler interface will not be useful.

The `JAXWSProperties` properties are defined in the following table.

<table>
<thead>
<tr>
<th>This property</th>
<th>Specifies</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESSAGE_ID</td>
<td>Message ID for the request. The client can set this property on the request context to override the auto-generation of the per-request Message ID header.</td>
</tr>
<tr>
<td>PERSISTENT_CONTEXT</td>
<td>Context properties required by the client or the communication channels. Web service clients can persist context properties, as long as they are Serializable, for the request message. These properties will be available in the response context map available from the <code>Response</code> object when the asynchronous handler is invoked. For more information, see Section 12.8, &quot;Propagating Request Context to the Response.&quot;</td>
</tr>
<tr>
<td>RELATES_TO</td>
<td>Message ID to which the response correlates.</td>
</tr>
<tr>
<td>REQUEST_TIMEOUT</td>
<td>For synchronous operations using asynchronous client transport, maximum amount of time to block and wait for a response. This property default to 0 indicating no timeout.</td>
</tr>
</tbody>
</table>

In addition, web service clients can persist context properties, as long as they are Serializable, for the request message. Context properties can include those required by the client or the communication channels. Message properties can be stored as part of the `weblogic.wsee.jaxws.JAXWSProperties.PERSISTENT_CONTEXT` Map property and retrieved after the response message is returned. For complete details, see Section 12.8, "Propagating Request Context to the Response".

12.6 Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)

Web Services Make Connection is a client polling mechanism that provides an alternative to asynchronous client transport, typically to provide support for clients that are behind a firewall. WebLogic Server supports WS-MakeConnection version 1.1, as described in the Make Connection specification at: `http://docs.oasis-open.org/ws-rx/wsmc/200702`, and is backwards compatible with version 1.0.

Specifically, Make Connection:

- Enables the decoupling of the response message from the initiating transport request used to send the request message (similar to asynchronous client transport).
- Supports web service clients that are non-addressable and unable to accept an incoming connection (for example, clients behind a firewall).
- Enables a web service client to act as an MC-Initiator and the web service to act as an MC-Receiver, as defined by the WS-MakeConnection specification.

The following figure, borrowed from the Web Services Make Connection specification, shows a typical Make Connection message flow.
As shown in the previous figure, the Make Connection message flow is as follows:

1. The `getQuote()` request message is sent from the web service client (MC Initiator) to the web service (MC Receiver). The `ReplyTo` header contains a Make Connection anonymous URI that specifies the UUID for the MC Initiator.

   The MC Receiver receives the `getQuote()` message. The presence of the Make Connection anonymous URI in the `ReplyTo` header indicates that the response message can be sent back on the connection’s back channel or the client will use Make Connection polling to retrieve it.

2. The MC Receiver closes the connection by sending back an empty response (HTTP 202) to the MC Initiator.

   Upon receiving an empty response, the MC Initiator initializes and starts its polling mechanism to enable subsequent polls to be sent to the MC Receiver. Specifically, the MC Initiator polling mechanism starts a timer with expiration set to the interval configured for the time between successive polls.

3. Upon timer expiration, the MC Initiator sends a Make Connection message to the MC Receiver with the same Make Connection anonymous URI information in its message.

4. As the MC Receiver has not completed process the `getQuote()` operation, no response is available to send back to the MC Initiator. As a result, the MC Receiver closes the connection by sending back another empty response (HTTP 202) indicating that no responses are available at this time.

   Upon receipt of the empty message, the MC Initiator restarts the timer for the Make Connection polling mechanism.

   Before the timer expires, the `getQuote()` operation completes. Since the original request contained a Make Connection anonymous URI in its `ReplyTo` header, the MC Receiver stores the response and waits to receive the next Make Connection message with a matching address.

5. Upon timer expiration, the MC Initiator sends a Make Connection message to the MC Receiver with the same Make Connection anonymous URI information in its message.

6. Upon receipt of the Make Connection message, the MC Receiver retrieves the stored response message and sends it as a response to the received Make Connection message.
The MC Initiator receives the response message and terminates the Make Connection polling mechanism.

Make Connection transport is recommended when using asynchronous invocation from behind a firewall. For a list of programming models supported, see Table 12–2, "Transport Types for Invoking Web Services Asynchronously".

The following sections describe how to enable and configure Make Connection on a web service and client:

- Section 12.6.1, "Enabling and Configuring Make Connection on a Web Service"
- Section 12.6.2, "Enabling and Configuring Make Connection on a Web Service Client"

### 12.6.1 Enabling and Configuring Make Connection on a Web Service

Make Connection can be enabled by attaching a Make Connection policy assertion to the web service and then calling its methods from a client using the standard JAX-WS client APIs. A policy can be attached to a web service in one of the following ways:

- Adding an `@Policy` annotation to the JWS file. You can attach a Make Connection policy at the class level only.
- Adding reference to the policy to the web service WSDL.

The following sections describe the steps required to enable Make Connection on a web service:

- Section 12.6.1.1, "Creating the Web Service Make Connection WS-Policy File (Optional)"
- Section 12.6.1.2, "Programming the JWS File to Enable Make Connection"

#### 12.6.1.1 Creating the Web Service Make Connection WS-Policy File (Optional)

A WS-Policy file is an XML file that contains policy assertions that comply with the WS-Policy specification. In this case, the WS-Policy file contains web service Make Connection policy assertions.

WebLogic Server includes pre-packaged WS-Policy files that contain typical Make Connection assertions that you can use if you do not want to create your own WS-Policy file. The pre-packaged WS-Policy files that support Make Connection are listed in the following table. In some cases, both reliable messaging and Make Connection are enabled by the policy. For more information, see Appendix A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection".

---

**Note:** You can attach Make Connection policies at the class level only; you cannot attach the Make Connection policies at the method level.
You can use one of the pre-packaged Make Connection WS-Policy files included in WebLogic Server; these files are adequate for most use cases. You cannot modify the pre-packaged files. If the values do not suit your needs, you must create a custom WS-Policy file. For example, you may wish to configure support of Make Connection as required on the web service client side. The Make Connection policy assertions conform to the WS-PolicyAssertions specification.

To create a custom WS-Policy file that contains Make Connection assertions, use the following guidelines:

- The root element of a WS-Policy file is always `<wsp:Policy>`.
- To configure web service Make Connection, you simply add a `<wsmc:MCSupported>` child element to define the web service Make Connection support.
- The `<wsmc:MCSupported>` child element contains one policy attribute, `Optional`, that specifies whether Make Connection must be configured on the web service client. This attribute can be set to `true` or `false`, and is set to `true` by default. If set to `false`, then use of Make Connection is required and both the ReplyTo and FaultTo (if specified) headers must contain Make Connection anonymous URIs.

The following example enables Make Connection on the web service and specifies that Make Connection must be enabled on the web service client. In this example, the WS-Policy 1.5 protocol is used.

```xml
<?xml version="1.0"?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy"
xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702">
  <wsmc:MCSupported wsp15:Optional="false"/>
</wsp15:Policy>
```
12.6.1.2 Programming the JWS File to Enable Make Connection

This section describes how to enable Make Connection on the web service using a pre-packaged or custom Make Connection WS-Policy file. For information about creating a custom policy file, see Section 12.6.1.1, "Creating the Web Service Make Connection WS-Policy File (Optional)".

Use the @Policy annotation in your JWS file to specify that the web service has a WS-Policy file attached to it that contains Make Connection assertions. WebLogic Server delivers a set of pre-packaged WS-Policy files, as described in Appendix A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection".

Refer to the following guidelines when using the @Policy annotation for web service reliable messaging:

- You can attach the Make Connection policy at the class level only; you cannot attach the Make Connection policy at the method level.
- Use the uri attribute to specify the build-time location of the policy file, as follows:
  - If you have created your own WS-Policy file, specify its location relative to the JWS file. For example:
    ```
    @Policy(uri="McPolicy.xml", attachToWsdl=true)
    ```
    In this example, the McPolicy.xml file is located in the same directory as the JWS file.
  - To specify one of the pre-packaged WS-Policy files or a WS-Policy file that is packaged in a shared Java EE library, use the policy: prefix along with the name and path of the policy file. This syntax tells the jwsc Ant task at build-time not to look for an actual file on the file system, but rather, that the web service will retrieve the WS-Policy file from WebLogic Server at the time the service is deployed.
  ```
  @Policy(uri="policy:McPolicy.xml", attachToWsdl=true)
  ```
- To specify that the policy file is published on the Web, use the http: prefix along with the URL, as shown in the following example:
  ```
  @Policy(uri="http://someSite.com/policies/mypolicy.xml" attachToWsdl=true)
  ```
- Set the attachToWsdl attribute of the @Policy annotation to specify whether the policy file should be attached to the WSDL file that describes the public contract of the web service. Typically, you want to publicly publish the policy so that client applications know the reliable messaging capabilities of the web service. For this reason, the default value of this attribute is true.

**Note:** Shared Java EE libraries are useful when you want to share a WS-Policy file with multiple web services that are packaged in different Enterprise applications. As long as the WS-Policy file is located in the META-INF/policies or WEB-INF/policies directory of the shared Java EE library, you can specify the policy file in the same way as if it were packaged in the same archive at the web service. See "Creating Shared Java EE Libraries and Optional Packages" in Developing Applications for Oracle WebLogic Server for information about creating libraries and setting up your environment so the web service can locate the policy files.
For more information about the `@Policy` annotation, see "weblogic.jws.Policy" in
*WebLogic Web Services Reference for Oracle WebLogic Server*.

The following example shows a simple JWS file that enables Make Connection; see the
explanation after the example for coding guidelines that correspond to the Java code in

```java
package examples.webservices.async

import javax.jws.WebMethod;
import javax.jws.WebService;
import weblogic.jws.Policy;

/**
 * Simple reliable Web Service.
 */
@WebService(name="HelloWorldPortType",
            serviceName="HelloWorldService")
@Policy(uri="McPolicy.xml",
        attachToWsdl=true)
public class HelloWorldImpl {
    private static String onewaySavedInput = null;

    /**
     * A one-way helloWorld method that saves the given string for later
     * concatenation to the end of the message passed into helloWorldReturn.
     */
    @WebMethod()
    public void helloWorld(String input) {
        System.out.println("Hello World " + input);
        onewaySavedInput = input;
    }

    /**
     * This echo method concatenates the saved message from helloWorld
     * onto the end of the provided message, and returns it.
     */
    @WebMethod()
    public String echo(String input2) {
        System.out.println("Hello World " + input2 + onewaySavedInput);
        return input + onewaySavedInput;
    }
}
```

As shown in the previous example, the custom `McPolicy.xml` policy file is attached to
the web service at the class level, which means that the policy file is applied to all
public operations of the web service. You can attach a Make Connection policy at the
class level only; you cannot attach a Make Connection policy at the method level.

The policy file is attached to the WSDL file. For information about the pre-packaged
policies available and creating a custom policy, see *Section 12.6.1.1, "Creating the Web
Service Make Connection WS-Policy File (Optional)".

The `echo()` method has been marked with the `@WebMethod` JWS annotation, which
means it is a public operation called `echo`. Because of the `@Policy` annotation, the
operation using Make Connection transport protocol.
12.6.2 Enabling and Configuring Make Connection on a Web Service Client

**Note:** The Make Connection and asynchronous client transport features are mutually exclusive. If you attempt to enable both features on the same web service client, an error is returned. For more information about asynchronous client transport, see Section 12.5, "Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)."

It is recommended that you use the asynchronous handler feature, `AsyncClientHandlerFeature` when using the asynchronous callback handler programming model. For more information, see Section 12.5.2, "Developing the Asynchronous Handler Interface".

To enable Make Connection on a web service client, pass an instance of the `weblogic.wsee.mc.api.McFeature` as a parameter when creating the web service proxy or dispatch. A simple example of how to enable Make Connection is shown below.

```java
package examples.webservices.myservice.client;

import weblogic.wsee.mc.api.McFeature;
...
List<WebServiceFeature> features = new ArrayList<WebServiceFeature>();
...
McFeature mcFeature = new McFeature();
features.add(mcFeature);
...
// ... Implement asynchronous handler interface as described in
// Section 12.5.2, "Developing the Asynchronous Handler Interface."
// ....
AsyncClientHandlerFeature handlerFeature = new AsyncClientHandlerFeature(handler);
features.add(handlerFeature);
_backendServicePort = _service.getBackendServicePort(_features);
...
// Make the invocation. Our asynchronous handler implementation (set
// into the AsyncClientHandlerFeature above) receives the response.
String request = "Dance and sing";
System.out.println("Invoking DoSomething asynchronously with request: " + request);
anotherPort.doSomethingAsync(request);
...
}
}
```

To enable Make Connection on a web service client, pass an instance of the `weblogic.wsee.mc.api.McFeature` as a parameter when creating the web service proxy or dispatch. A simple example of how to enable Make Connection is shown below.

**Note:** This example will use synchronous transport for synchronous methods. To configure Make Connection as the transport for synchronous methods, see Section 12.6.2.4, "Configuring Make Connection as the Transport for Synchronous Methods."

To configure specific features of Make Connection on the web service client, as described in the following sections.

- Section 12.6.2.1, "Configuring the Expiration Time for Sending Make Connection Messages"
12.6.2.1 Configuring the Expiration Time for Sending Make Connection Messages

Table 12–10 defines that McFeature methods for configuring the maximum interval of time before an MC Initiator stops sending Make Connection messages to an MC Receiver.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>String getsExpires()</td>
<td>Returns the expiration value currently configured.</td>
</tr>
<tr>
<td>void setExpires(String expires)</td>
<td>Set the expiration time. The value specified must be a positive value and conform to the XML schema duration lexical format, ( P^nY^nM^nD^nT^nH^nM^nS ), where ( nY ) specifies the number of years, ( nM ) specifies the number of months, ( nD ) specifies the number of days, ( T ) is the date/time separator, ( nH ) specifies the number of hours, ( nM ) specifies the number of minutes, and ( nS ) specifies the number of seconds. This value defaults to ( P1D ) (1 day).</td>
</tr>
</tbody>
</table>

12.6.2.2 Configuring the Polling Interval

Table 12–11 defines that McFeature methods for configuring the interval of time that must pass before a Make Connection message is sent by an MC Initiator to an MC Receiver after the receipt of an empty response message. If the MC Initiator does not receive a non-empty response for a given message within the specified interval, the MC Initiator sends another Make Connection message.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>String getInterval()</td>
<td>Gets the polling interval.</td>
</tr>
<tr>
<td>void setInterval(String pollingInterval)</td>
<td>Set the polling interval. The value specified must be a positive value and conform to the XML schema duration lexical format, ( P^nY^nM^nD^nT^nH^nM^nS ), where ( nY ) specifies the number of years, ( nM ) specifies the number of months, ( nD ) specifies the number of days, ( T ) is the date/time separator, ( nH ) specifies the number of hours, ( nM ) specifies the number of minutes, and ( nS ) specifies the number of seconds. This value defaults to ( P0DT5S ) (5 seconds).</td>
</tr>
</tbody>
</table>

In the following example, the polling interval is set to 36 hours.

```java
McFeature mcFeature = new McFeature();
mcFeature.setInterval("P0DT36H");
MyService port = service.getMyServicePort(mcFeature);
```
12.6.2.3 Configuring the Exponential Backoff

Table 12–12 defines the McFeature methods for configuring the exponential backoff flag. This flag specifies whether the polling interval, described in Section 12.6.2.2, "Configuring the Polling Interval", will be adjusted using the exponential backoff algorithm. In this case, if the MC Initiator does not receive a non-empty response for the time interval specified by the polling interval, the exponential backoff algorithm is used for timing successive retransmissions by the MC Initiator, should the response not be received.

The exponential backoff algorithm specifies that successive polling intervals should increase exponentially, based on the polling interval. For example, if the polling interval is 2 seconds, and the exponential backoff element is set, successive polling intervals if the response is not received are 2, 4, 8, 16, 32, and so on.

This value defaults to false, the same polling interval is used in successive retries; the interval does not increase exponentially.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean isExponentialBackoff()</td>
<td>Returns a boolean value indicating whether exponential backoff is enabled.</td>
</tr>
<tr>
<td>void setExponentialBackoff(boolean backoff)</td>
<td>Set the exponential backoff flag. Valid values are true and false. This flag defaults to false.</td>
</tr>
</tbody>
</table>

In the following example, enables the exponential backoff flag.

```java
McFeature mcFeature = new McFeature();
mcFeature.setMessageInterval(P0DT36H)
mcFeature.setExponentialBackoff(true);
MyService port = service.getMyServicePort(mcFeature);
```

12.6.2.4 Configuring Make Connection as the Transport for Synchronous Methods

By default, synchronous methods use synchronous transport even when Make Connection is enabled on the client. You can configure your client to use Make Connection as the transport for synchronous methods. In this case, Make Connection messages are sent by the MC Initiator based on the configured polling interval (described in Section 12.6.2.2, "Configuring the Polling Interval") until a non-empty response message is received.

To configure Make Connection as the transport protocol to use for synchronous methods, use one of the following methods:

- When instantiating a new McFeature() object, you can pass as a parameter a boolean value that specifies whether Make Connection should be used as the transport protocol for synchronous methods. For example:

```java
McFeature mcFeature = new McFeature(true);
MyService port = service.getMyServicePort(mcFeature);
```
Use the McFeature methods defined in Table 12–13. For example:

```java
...,
    McFeature mcFeature = new McFeature();
    mcFeature.setUseMCWithSyncInvoke(true);
    MyService port = service.getMyServicePort(mcFeature);
...,
```

You can set the maximum amount of time a synchronous method will block and wait for a response using the `weblogic.wsee.jaxws.JAXWSProperties.REQUEST_TIMEOUT` property. This property default to 0 indicating no timeout. For more information about setting message properties, see Section 12.5.3, "Propagating User-defined Request Context to the Response".

### Table 12–13 Methods for Configuring Synchronous Method Support

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean isUseMCWithSyncInvoke()</td>
<td>Returns a boolean value indicating whether synchronous method support is enabled.</td>
</tr>
<tr>
<td>void setUseMCWithSyncInvoke(boolean useMCWithSyncInvoke)</td>
<td>Sets the synchronous method support flag. Valid values are true and false. This flag defaults to false.</td>
</tr>
</tbody>
</table>

12.7 Using the JAX-WS Reference Implementation

The JAX-WS Reference Implementation (RI) supports the following programming models:

- Asynchronous client polling through use of the `java.util.concurrent.Future` interface.
- Asynchronous callback handlers on a per request basis. The calling client specifies the callback handler at invocation time. When the response is available, the callback handler is invoked to process the response.

Unlike with asynchronous client transport feature, the JAX-WS RI provides very limited support for WS-Addressing, including:

- Manual support for publishing the client-side endpoint to receive responses.
- No support for detecting incorrect client-side programming model (resulting in synchronous call hanging, for example).
- No support for surviving a client-side or service-side restart.

The following example shows a simple client file, `AsyncClient`, that has a single method, `AddNumbersTestDrive`, that asynchronously invokes the `AddNumbersAsync` method of the `AddNumbersService` service. The Java code in bold is described following the code sample.

```java
package examples.webservices.async.client;

import java.util.concurrent.ExecutionException;
import java.util.concurrent.TimeUnit;
import javax.xml.ws.BindingProvider;
```

Developing Asynchronous Clients 12-27
import java.util.concurrent.Future;
import javax.xml.ws.AsyncHandler;
import javax.xml.ws.Response;

public class AsyncClient {

    private AddNumbersPortType port = null;
    protected void setUp() throws Exception {
        AddNumbersService service = new AddNumbersService();
        port = service.getAddNumbersPort();
        String serverURI = System.getProperty("wls-server");
        ((BindingProvider) port).getRequestContext().put("http://" + serverURI + "/JAXWS_ASYNC/AddNumbersService");
    }

    /**
     * Asynchronous callback handler
     */
    class AddNumbersCallbackHandler implements AsyncHandler<AddNumbersResponse> {
        private AddNumbersResponse output;
        public void handleResponse(Response<AddNumbersResponse> response) {
            try {
                output = response.get();
            } catch (ExecutionException e) {
                e.printStackTrace();
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
        AddNumbersResponse getResponse() {
            return output;
        }
    }

    public void AddNumbersTestDrive() throws Exception {
        int number1 = 10;
        int number2 = 20;

        // Asynchronous Callback method
        AddNumbersCallbackHandler callbackHandler =
            new AddNumbersCallbackHandler();
        Future<?> resp = port.addNumbersAsync(number1, number2, callbackHandler);

        // For the purposes of a test, block until the async call completes
        resp.get(5L, TimeUnit.MINUTES);
        int result = callbackHandler.getResponse().getReturn();

        // Polling method
        Response<AddNumbersResponse> addNumbersResp =
            port.AddNumbersAsync(number1, number2);
        while (!addNumbersResp.isDone()) {
            Thread.sleep(100);
        }
        AddNumbersResponse reply = addNumbersResp.get();
        System.out.println("Server responded through polling with: " + reply.getResponseType());
    }
}
The example demonstrates the steps to implement both the asynchronous polling and asynchronous callback handler programming models.

To implement an asynchronous callback handler:

1. Create an asynchronous handler that implements the `javax.xml.ws.AsyncHandler<T>` interface (see http://docs.oracle.com/javaee/7/api/javax/xml/ws/AsyncHandler.html). The asynchronous handler defines one method, `handleResponse`, that enables clients to receive callback notifications at the completion of service endpoint operations that are invoked asynchronously. The type should be set to `AddNumberResponse`.

   ```java
   class AddNumbersCallbackHandler implements AsyncHandler<AddNumbersResponse> {
       private AddNumbersResponse output;

       public void handleResponse(Response<AddNumbersResponse> response) {
           try {
               output = response.get();
           } catch (ExecutionException e) {
               e.printStackTrace();
           } catch (InterruptedException e) {
               e.printStackTrace();
           }
       }

       AddNumbersResponse getResponse() {
           return output;
       }
   }
   ```

2. Instantiate the asynchronous callback handler.

   ```java
   AddNumbersCallbackHandler callbackHandler = new AddNumbersCallbackHandler();
   ```

3. Instantiate the `AddNumbersService` web service and call the asynchronous version of the web service method, `addNumbersAsync`, passing a handle to the asynchronous callback handler.

   ```java
   AddNumbersService service = new AddNumbersService();
   port = service.getAddNumbersPort();
   ...

   Future<?> resp = port.addNumbersAsync(number1, number2, callbackHandler);
   ```

   `java.util.concurrent.Future` (see https://docs.oracle.com/javase/8/docs/api/java/util/concurrent/Future.html) represents the result of an asynchronous computation and provides methods for checking the status of the asynchronous task, getting the result, or canceling the task execution.

4. Get the result of the asynchronous computation. In this example, a timeout value is specified to wait for the computation to complete.

   ```java
   resp.get(5L, TimeUnit.MINUTES);
   ```

5. Use the callback handler to access the response message.

   ```java
   int result = callbackHandler.getResponse().getReturn();
   ```
To implement an asynchronous polling mechanism:

1. Instantiate the AddNumbersService web service and call the asynchronous version of the web service method, addNumbersAsync.

   ```java
   Response<AddNumbersResponse> addNumbersResp =
   port.AddNumbersAsync(number1, number2);
   ```

2. Sleep until a message is received.

   ```java
   while (!addNumbersResp.isDone()) {
     Thread.sleep(100);
   }
   ```

3. Poll for a response.

   ```java
   AddNumbersResponse reply = addNumbersResp.get();
   ```

12.8 Propagating Request Context to the Response

WebLogic Server provides a powerful facility that enables you to attach your business context—for example, a business-level message ID—to the request message and access it when the response is returned, regardless of what the request and response messages convey over the wire. For example, you may have a business-level message ID that will not otherwise be available in the response message. By propagating this information with the message, you can access it when the response message is returned.

Web service clients can store any request message context property, as long as it is Serializable. Message context properties can be stored as part of the `weblogic.wsee.jaxws.JAXWSProperties.PERSISTENT_CONTEXT` Map property and retrieved after the response message is returned.

The following example shows how to use the `PERSISTENT_CONTEXT` Map property to define and set a message context property.

```java
Example 12–3 Setting Message Context Properties

import weblogic.wsee.jaxws.JAXWSProperties;
...
MyClientPort port = myService.getPort();
Map<String, Serializable> clientPersistProps =
  port.getRequestContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
Serializable obj = <my_property>;
clientPersistProps.put("MyProperty", obj);

port.myOperationAsync(<args>, new AsyncHandler<MyOperationResponse>() {
  public void handleResponse(Response<MyOperationResponse> res) {
    try {
      // Get the actual response
      MyOperationResponse response = res.get().getReturn();

      // Get the property stored when making request. Note, this property did not get
      // passed over the wire with the request. The web services runtime stores it.
      Map<String, Serializable> clientPersistProps =
        res.getContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
      Serializable obj = clientPersistProps.get("MyProperty");
      // Do something with MyProperty
    } catch (Exception e) {
      // Error handling
    }
  }
});
```
12.9 Monitoring Asynchronous Web Service Invocation

You can monitor runtime information for clients that invoke web services asynchronously, such as number of invocations, errors, faults, and so on, using the WebLogic Server Administration Console. To monitor web service clients, click on the Deployments node in the left pane and, in the Deployments table that appears in the right pane, locate the Enterprise application in which the web service client is packaged. Expand the application by clicking the + node and click on the application module within which the web service client is located. Click the Monitoring tab, then click the Web Service Clients tab.

If you use the Make Connection transport protocol, you can monitor the Make Connection anonymous endpoints for a web service or client. For each anonymous endpoint, runtime monitoring information is displayed, such as the number of messages received, the number of messages pending, and so on.

You can customize the information that is shown in the table by clicking Customize this table.

To monitor Make Connection anonymous endpoints for a web service, click on the Deployments node in the left pane and, in the Deployments table that appears in the right pane, locate the Enterprise application in which the web service is packaged. Expand the application by clicking the + node; the web services in the application are listed under the Web Services category. Click on the name of the web service and select Monitoring> Ports> Make Connection.

To monitor Make Connection anonymous endpoints for a web service client, click on the Deployments node in the left pane and, in the Deployments table that appears in the right pane, locate the Enterprise application in which the web service client is packaged. Expand the application by clicking the + node and click on the application module within which the web service client is located. Click the Monitoring tab, then click the Web Service Clients tab. Then click Monitoring> Servers> Make Connection.

12.10 Clustering Considerations for Asynchronous Web Service Messaging

When a web service client runs in a cluster, you need to make special allowances to ensure that the response messages can be delivered properly to the asynchronous response endpoint for asynchronous calls. You defined the asynchronous response endpoint with the AsyncClientTransportFeature, as described in Section 12.5.1, "Enabling and Configuring the Asynchronous Client Transport Feature".

Consider the scenario shown in the following figure.
In the scenario shown in the previous figure:

- A two-node cluster hosts the client application; the nodes are named Server1 and Server2. The cluster has a simple load-balancing front-end proxy.
- The client application is a Web application called ClientWebApp which is deployed homogeneously to the cluster. In other words, the Web application runs on both member servers in the cluster.
- External clients of the ClientWebApp application make requests through the cluster front-end address.

Now consider the following sequence:

1. An external client requests a page from ClientWebApp via the cluster front-end.
2. The cluster front-end load balances the page request and sends it to the ClientWebApp on Server1.
3. ClientWebApp on Server1 creates an instance of a web service client, BackendServiceClient, to communicate with its back-end service, BackendService. The creation of BackendServiceClient causes an asynchronous response endpoint to be published to receive asynchronous responses whenever BackendServiceClient is used to make an asynchronous request.
4. ClientWebApp on Server1 calls BackendServiceClient.doSomethingAsync() to perform an operation on the backend service. The address of the asynchronous response endpoint is included in the ReplyTo address. This address starts with the address of the cluster front end, and not the address of Server1.
5. The cluster receives the response to the doSomething operation.
6. The cluster load balances the message, this time to Server2.

7. The message delivery fails because there is no asynchronous response endpoint on Server2 to receive the response.

You can use one of the following to resolve this problem:

- Use a SOAP-aware cluster front-end proxy plug-in, such as WebLogic Server HttpClusterServlet. For more information, see "Configure Proxy Plug-ins" in Administering Clusters for Oracle WebLogic Server. This option may not be feasible, for example if your company has standardized on a cluster front-end technology.

- Ensure that all member servers in a cluster publish an asynchronous response endpoint so that the asynchronous response messages can be delivered to any member server and optionally forwarded to the correct server via in-place cluster routing.

To implement the second option, it is recommended that you define a singleton port instance and initialize it when the client container initializes (upon deployment). For an example illustrating the recommended method for initializing the asynchronous response endpoint in a cluster, see Example 11–1, "Asynchronous Web Service Client Best Practices Example".

**Note:** You may choose to initialize the endpoint in different ways depending on the container type. For example, if the client is hosted in a web service, a method on the web service container could be annotated with @PostConstruct and that method could initialize the singleton port. In an EJB container, you could use the ejbCreate() method as the trigger point for creating the singleton port.
This chapter presents best practices for developing WebLogic web services and clients for Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 13.1, "Roadmap for Developing Reliable Web Service Clients"
- Section 13.2, "Roadmap for Developing Reliable Web Services"
- Section 13.3, "Roadmap for Accessing Reliable Web Services from Behind a Firewall (Make Connection)"
- Section 13.4, "Roadmap for Securing Reliable Web Services"

Note: See also Section 21.2, "Roadmap for Configuring Web Service Persistence."

### 13.1 Roadmap for Developing Reliable Web Service Clients

Table 13–1 provides best practices for developing reliable web service clients, including an example that illustrates the best practices presented. These guidelines should be used in conjunction with the guidelines provided in Chapter 7, "Roadmap for Developing JAX-WS Web Service Clients."

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always implement a reliability error listener.</td>
<td>For more information, see Section 14.8, &quot;Implementing the Reliability Error Listener.&quot;</td>
</tr>
<tr>
<td>Group messages into units of work.</td>
<td>Rather than incur the RM sequence creation and termination protocol overhead for every message sent, you can group messages into business units of work—also referred to as batching. For more information, see Section 14.11, &quot;Grouping Messages into Business Units of Work (Batching).&quot;</td>
</tr>
</tbody>
</table>

Note: This best practice is not demonstrated in Example 13–1.
The following example illustrates best practices for developing reliable web service clients.

**Example 13–1 Reliable Web Service Client Best Practices Example**

```java
import java.io.*;
import java.util.*;
import javax.servlet.*;
import javax.xml.bind.JAXBContext;
import javax.xml.ws.*;
import weblogic.jws.jaxws.client.ClientIdentityFeature;
import weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature;
import weblogic.jws.jaxws.client.async.AsyncClientTransportFeature;
import weblogic.wsee.reliability2.api.ReliabilityErrorContext;
import weblogic.wsee.reliability2.api.ReliabilityErrorListener;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
import com.sun.xml.ws.developer.JAXWSProperties;

importjavax.ws.jar.JAXWSProperties;

/**
 * Example client for invoking a reliable web service asynchronously.
 */
public class BestPracticeAsyncRmClient
extends GenericServlet {

private BackendReliableServiceService _service;
private BackendReliableService _singletonPort;
private WebServiceFeature[] _features;

private static int _requestCount;
private static String _lastResponse;
private static final String MY_PROPERTY = "MyProperty";

@Override
public void init()
throws ServletException {

_requestCount = 0;
_lastResponse = null;

// Only create the web service object once as it is expensive to create repeatedly.

The recommended setting is two times the nominal interval between requests. For more information, see Section 14.7.9, "Configuring the Acknowledgement Interval."

**Note:** This best practice is not demonstrated in Example 13–1.

The recommended setting is two times the acknowledgement interval or nominal response time, whichever is greater. For more information, see Section 14.7.4, "Configuring the Base Retransmission Interval."

**Note:** This best practice is not demonstrated in Example 13–1.

For more information, see Section 14.7.7, "Configuring Inactivity Timeout" and Section 14.7.6, "Configuring the Sequence Expiration."

**Note:** This best practice is not demonstrated in Example 13–1.

---

### Table 13–1 (Cont.) Roadmap for Developing Reliable Web Service Clients

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set the acknowledgement interval to a realistic value for your particular scenario.</td>
<td>The recommended setting is two times the nominal interval between requests. For more information, see Section 14.7.9, &quot;Configuring the Acknowledgement Interval.&quot; <strong>Note:</strong> This best practice is not demonstrated in Example 13–1.</td>
</tr>
<tr>
<td>Set the base retransmission interval to a realistic value for your particular scenario.</td>
<td>The recommended setting is two times the acknowledgement interval or nominal response time, whichever is greater. For more information, see Section 14.7.4, &quot;Configuring the Base Retransmission Interval.&quot; <strong>Note:</strong> This best practice is not demonstrated in Example 13–1.</td>
</tr>
<tr>
<td>Set timeouts (inactivity and sequence expiration) to realistic values for your particular scenario.</td>
<td>For more information, see Section 14.7.7, &quot;Configuring Inactivity Timeout&quot; and Section 14.7.6, &quot;Configuring the Sequence Expiration.&quot; <strong>Note:</strong> This best practice is not demonstrated in Example 13–1.</td>
</tr>
</tbody>
</table>
if (_service == null) {
    _service = new BackendReliableServiceService();
}

// Best Practice: Use a stored list of features, per client ID, to create client instances.
// Define all features for the web service port, per client ID, so that they are
// consistent each time the port is called. For example:
// _service.getBackendServicePort(_features);

List<WebServiceFeature> features = new ArrayList<WebServiceFeature>();

// Best Practice: Explicitly define the client ID.
ClientIdentityFeature clientIdFeature =
    new ClientIdentityFeature("MyBackendServiceAsyncRmClient");
features.add(clientIdFeature);

// Best Practice: Always implement a reliability error listener.
// Include this feature in your reusable feature list. This enables you to determine
// a reason for failure, for example, RM cannot deliver a request or the RM sequence fails in
// some way (for example, client credentials refused at service).
WsrmClientInitFeature rmFeature = new WsrmClientInitFeature();
features.add(rmFeature);
rmFeature.setErrorListener(new ReliabilityErrorListener() {
    public void onReliabilityError(ReliabilityErrorContext context) {
        // At a *minimum* do this
        System.out.println("RM sequence failure: " +
            context.getFaultSummaryMessage());
        _lastResponse = context.getFaultSummaryMessage();

        // And optionally do this...
        // The context parameter conveys whether a request or the entire
        // sequence has failed. If a sequence fails, you will get a notification
        // for each undelivered request (if any) on the sequence.
        if (!context.isRequestSpecific()) {
            // Single request failure (possibly as part of a larger sequence failure).
            // Retrieve the original request.
            String operationName = context.getOperationName();
            System.out.println("Failed to deliver request for operation " +
                operationName + ". Fault summary: " +
                context.getFaultSummaryMessage());
            if ("DoSomething".equals(operationName)) {
                try {
                    String request = context.getRequest(JAXBContext.newInstance(),
                        String.class);
                    System.out.println("Failed to deliver request for operation " +
                        operationName + " with content: " +
                        request);
                    Map<String, Serializable> requestProps =
                        context.getUserRequestContextProperties();
                    if (requestProps != null) {
                        // Retrieve the request property. Use MyProperty
                        // to describe the request that failed and print this value
                        // during the simple `error recovery` below.
                        String myProperty = (String) requestProps.get(MY_PROPERTY);
                        System.out.println("Got MyProperty value propagated from request: " +
                            myProperty);
                        System.out.println(myProperty + " failed!");
                    }
                }
            }
        }
    }
});
try {
    // Show getting the MyProperty value back.
    DoSomethingResponse response = res.get();
    _lastResponse = response.getReturn();
    System.out.println("Got (reliable) async response: " + _lastResponse);
    // Retrieve the request property. This property can be used to
    // 'remember' the context of the request and subsequently process
    // the response.
    Map<String, Serializable> requestProps =
        (Map<String, Serializable>) res.getContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
    String myProperty = (String) requestProps.get(MY_PROPERTY);
    System.out.println("Got MyProperty value propagated from request: " + myProperty);
} catch (Exception e) {
    _lastResponse = e.toString();
    e.printStackTrace();
}

AsyncClientHandlerFeature handlerFeature =
    new AsyncClientHandlerFeature(handler);
features.add(handlerFeature);

// Set the features used when creating clients with
// the client ID 'MyBackendServiceAsyncRmClient.'
_features = features.toArray(new WebServiceFeature[features.size()]);

// Best Practice: Define a singleton port instance and initialize it when
// the client container initializes (upon deployment).
// The singleton port will be available for the life of the servlet.
// Creation of the singleton port triggers the asynchronous response endpoint to be published
// and it will remain published until our container (Web application) is undeployed.
// Note, we will get a call to destroy() before this.
_singletonPort = _service.getBackendReliableServicePort(_features);
```java
@Override
public void service(ServletRequest req, ServletResponse res)
    throws ServletException, IOException {
    // TODO: ... Read the servlet request ...

    // For this simple example, echo the _lastResponse captured from
    // an asynchronous DoSomethingResponse response message.
    if (_lastResponse != null) {
        res.getWriter().write(_lastResponse);
        _lastResponse = null; // Clear the response so we can get another
        return;
    }

    // Set _lastResponse to NULL in order to make a new invocation against
    // BackendService to generate a new response

    // Best Practice: Synchronize use of client instances.
    // Create another port using the "exact" same features used when creating _singletonPort.
    // Note, this port uses the same client ID as the singleton port and it is effectively the
    // same as the singleton from the perspective of the web services runtime.
    // This port will use the asynchronous response endpoint for the client ID,
    // as it is defined in the _features list.
    // NOTE: This is "DEFINITELY" not best practice or ideal because our application is
    // incurring the cost of an RM handshake and sequence termination
    // for *every* reliable request sent. It would be better to send
    // multiple requests on each sequence. If there is not a natural grouping
    // for messages (a business 'unit of work'), then you could batch
    // requests onto a sequence for efficiency. For more information, see
    // Section 14.11, "Grouping Messages into Business Units of Work (Batching)."
    BackendReliableService anotherPort =
        _service.getBackendReliableServicePort(_features);

    // Set the endpoint address for BackendService.
    ((BindingProvider)anotherPort).getRequestContext().
        put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
            "http://localhost:7001/BestPracticeReliableService/BackendReliableService");

    // Make the invocation. Our asynchronous handler implementation (set
    // into the AsyncClientHandlerFeature above) receives the response.
    String request = "Protect and serve";
    System.out.println("Invoking DoSomething reliably/async with request: " +
        request);
    // Add a persistent context property that will be returned on the response.
    // This property can be used to 'remember' the context of this
    // request and subsequently process the response. This property will "not"
    // get passed over wire, so the properties can change independent of the
    // application message.
    Map<String, Serializable> persistentContext =
        (Map<String, Serializable>)((BindingProvider)anotherPort).
            getRequestContext().get(JAXWSProperties.PERSISTENT_CONTEXT);
    String myProperty = "Request" + (++_requestCount);
    persistentContext.put(MY_PROPERTY, myProperty);
    System.out.println("Request being made (reliably) with MyProperty value: " +
        myProperty);
    anotherPort.doSomethingAsync(request);
```
// Return a canned string indicating the response was not received
// synchronously. Client needs to invoke the servlet again to get
// the response.
res.getWriter().write("Waiting for response...");

// Best Practice: Explicitly close client instances when processing is complete.
// If not closed, the port will be closed automatically when it goes out of scope.
// This will force the termination of the RM sequence we created when sending the first
// doSomething request. For a better way to handle this, see
// Section 14.11, "Grouping Messages into Business Units of Work (Batching)."
// NOTE: Even though the port is closed explicitly (or even if it goes out of scope)
// the reliable request sent above will still be delivered
// under the scope of the client ID used. So, even if the service endpoint
// is down, RM retries the request and delivers it when the service endpoint
// available. The asynchronous response will be delivered as if the port instance was
// still available.
((java.io.Closeable)anotherPort).close();

@Override
public void destroy() {

try {
    // Best Practice: Explicitly close client instances when processing is complete.
    // Close the singleton port created during initialization. Note, the asynchronous
    // response endpoint generated by creating _singletonPort *remains*
    // published until our container (Web application) is undeployed.
    ((java.io.Closeable)_singletonPort).close();
    // Upon return, the Web application is undeployed, and our asynchronous
    // response endpoint is stopped (unpublished). At this point,
    // the client ID used for _singletonPort will be unregistered and will no longer be
    // visible from the Administration Console and WLST.
    } catch (Exception e) {
        e.printStackTrace();
    }
}
Table 13–2  Roadmap for Developing Reliable Web Services

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set the base retransmission interval to a realistic value for your particular scenario.</td>
<td>For more information, see Section 14.7.4, &quot;Configuring the Base Retransmission Interval.&quot;</td>
</tr>
<tr>
<td>Set the acknowledgement interval to a realistic value for your particular scenario.</td>
<td>The recommended setting is two times the nominal interval between requests. For more information, see Section 14.7.9, &quot;Configuring the Acknowledgement Interval.&quot;</td>
</tr>
</tbody>
</table>
| Set timeouts (inactivity and sequence expiration) to realistic values for your particular scenario. | Consider the following:  
- For very short-lived exchanges, the default timeouts may be too long and sequence state might be maintained longer than necessary.  
- Set timeouts to two times the expected lifetime of a given business unit of work. This allows the sequence to live long enough  
For more information, see Section 14.7.7, "Configuring Inactivity Timeout" and Section 14.7.6, "Configuring the Sequence Expiration." |
| Use an reliable messaging policy that reflects the minimum delivery assurance (or quality of service) required. | By default, the delivery assurance is set to Exactly Once, In Order. If you do not require ordering, it can increase performance to set the delivery assurance to simply Exactly Once. Similarly, if your service can tolerate duplicate requests, delivery assurance can be set to At Least Once.  
For more information about delivery assurance for reliable messaging, see Table 14–1, "Delivery Assurances for Reliable Messaging" and Section 14.4, "Creating the Web Service Reliable Messaging WS-Policy File." |

13.3 Roadmap for Accessing Reliable Web Services from Behind a Firewall (Make Connection)

Table 13–3 provides best practices for accessing reliable web services from behind a firewall using Make Connection. These guidelines should be used in conjunction with the general guidelines provided in Section 13.2, "Roadmap for Developing Reliable Web Services" and Chapter 11, "Roadmap for Developing Asynchronous Web Service Clients."
Table 13–3 Roadmap for Accessing Reliable Web Services from Behind a Firewall (Make Connection)

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
</table>
| Coordinate the Make Connection polling interval with the reliable messaging base retransmission interval. | The polling interval you set for Make Connection transport sets the lower limit for the amount of time it takes for reliable messaging protocol messages to make the round trip between the client and service. If you set the reliable messaging base retransmission interval to a value near to the Make Connection polling interval, it will be unlikely that a reliable messaging request will be received by the web service, and the accompanying RM acknowledgement sent for that request (at best one Make Connection polling interval later) before the reliable messaging runtime attempts to retransmit the request. Setting the reliable messaging base retransmission interval to a value that is too low results in unnecessary retransmissions for requests, and potentially a cascading load on the service side as it attempts to process redundant incoming requests and Make Connection poll messages to retrieve the responses from those requests.

Oracle recommends setting the base retransmission interval to a value that is at least two times the Make Connection polling interval.

Note: When web services reliable messaging and Make Connection are used together, the Make Connection polling interval value will be adjusted at runtime, if necessary, to ensure that the value is set at least 3 seconds less than the reliable messaging base transmission interval. If the base transmission interval is three seconds or less, the Make Connection polling interval is set to the value of the base retransmission interval.

For more information setting the Make Connection polling interval and reliable messaging base retransmission interval, see Section 12.6.2.2, "Configuring the Polling Interval" and Section 14.7.4, "Configuring the Base Retransmission Interval", respectively. |

Table 13–4 Roadmap for Securing Reliable Web Services

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
</table>
| Coordinate the WS-SecureConversation lifetime with the reliable messaging base retransmission and acknowledgement intervals. | A WS-SecureConversation lifetime that is set to a value near to or less than the reliable messaging base retransmission and acknowledgement intervals may result in the WS-SecureConversation token expiring before the reliable messaging handshake message can be sent to the web service. For this reason, Oracle recommends setting the WS-SecureConversation lifetime to a value that is at least two times the base retransmission interval.

For more information setting the base retransmission interval, see Section 14.7.4, "Configuring the Base Retransmission Interval." |
This chapter describes how to use web services reliable messaging (WS-ReliableMessaging) for WebLogic web services using Java API for XML Web Services (JAX-WS).

See also Section 13, "Roadmap for Developing Reliable Web Services and Clients".

This chapter includes the following sections:

- Section 14.1, "Overview of Web Services Reliable Messaging"
- Section 14.2, "Steps to Create and Invoke a Reliable Web Service"
- Section 14.3, "Configuring the Source and Destination WebLogic Server Instances"
- Section 14.4, "Creating the Web Service Reliable Messaging WS-Policy File"
- Section 14.5, "Programming Guidelines for the Reliable JWS File"
- Section 14.6, "Invoking a Reliable Web Service from a Web Service Client"
- Section 14.7, "Configuring Reliable Messaging"
- Section 14.8, "Implementing the Reliability Error Listener"
- Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence"
- Section 14.10, "Monitoring Web Services Reliable Messaging"
- Section 14.11, "Grouping Messages into Business Units of Work (Batching)"
- Section 14.12, "Client Considerations When Redeploying a Reliable Web Service"
- Section 14.13, "Interoperability with WebLogic Web Service Reliable Messaging"

The WebLogic Server Examples Server includes three reliable messaging examples:

- Configuring Reliable Messaging for JAX-WS Web Services
- Using Make Connection and Reliable Messaging for JAX-WS Web Services
- Configuring Secure and Reliable Messaging for JAX-WS Web Services

For more information, see "Web Services Samples in the WebLogic Server Distribution" in Understanding WebLogic Web Services for Oracle WebLogic Server.

14.1 Overview of Web Services Reliable Messaging

Web service reliable messaging is a framework that enables an application running on one application server to reliably invoke a web service running on another application server, assuming that both servers implement the WS-ReliableMessaging specification. Reliable is defined as the ability to guarantee message delivery between the two
WebLogic web services conform to the WS-ReliableMessaging 1.2 specification (February 2009) at http://docs.oasis-open.org/ws-rx/wsrm/200702 (and supports version 1.1). This specification describes how two endpoints (web service and client) on different application servers can communicate reliably. In particular, the specification describes an interoperable protocol in which a message sent from a source endpoint (or client web service) to a destination endpoint (or web service whose operations can be invoked reliably) is guaranteed either to be delivered, according to one or more delivery assurances, or to raise an error.

A reliable WebLogic web service provides the following delivery assurances.

**Table 14–1  Delivery Assurances for Reliable Messaging**

<table>
<thead>
<tr>
<th>Delivery Assurance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Most Once</td>
<td>Messages are delivered at most once, without duplication. It is possible that some messages may not be delivered at all.</td>
</tr>
<tr>
<td>At Least Once</td>
<td>Every message is delivered at least once. It is possible that some messages are delivered more than once.</td>
</tr>
<tr>
<td>Exactly Once</td>
<td>Every message is delivered exactly once, without duplication.</td>
</tr>
<tr>
<td>In Order</td>
<td>Messages are delivered in the order that they were sent. This delivery assurance can be combined with one of the preceding three assurances.</td>
</tr>
</tbody>
</table>

The following sections describe how to create reliable web services and clients and how to configure WebLogic Server instances to which the web services are deployed.

### 14.1.1 Using WS-Policy to Specify Reliable Messaging Policy Assertions

WebLogic web services use WS-Policy files to enable a destination endpoint to describe and advertise its web service reliable messaging capabilities and requirements. The WS-Policy files are XML files that describe features such as the version of the supported WS-ReliableMessaging specification and quality of service requirements. The WS-Policy specification (http://www.w3.org/TR/ws-policy/) provides a general purpose model and syntax to describe and communicate the policies of a web service.

WebLogic Server includes pre-packaged WS-Policy files that contain typical reliable messaging assertions, as described in Section A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection". If the pre-packaged WS-Policy files do not suit your needs, you must create your own WS-Policy file. See Section 14.4, "Creating the Web Service Reliable Messaging WS-Policy File" for details. See "Web Service Reliable Messaging Policy Assertion Reference" in the WebLogic Web Services Reference for Oracle WebLogic Server for reference information about the reliable messaging policy assertions.

### 14.1.2 Supported Transport Types for Reliable Messaging

You can use web service reliable messaging asynchronously or synchronously. When delivering messages asynchronously, you can configure buffering to support automatic message delivery retries, if desired.

The following table summarizes the transport type support for web services reliable messaging. For information about transport type support for web service clients, see
Section 14.6, "Invoking a Reliable Web Service from a Web Service Client". For failure recovery information, see Section 14.1.4, "Reliable Messaging Failure Recovery Scenarios"

**Note:** Message buffering is configurable for web services, as described in Chapter 22, "Configuring Message Buffering for Web Services.". For web service clients, message buffering is enabled by default.

### Table 14–2 Transport Types for Web Services Reliable Messaging

<table>
<thead>
<tr>
<th>Transport Type</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asynchronous transport</td>
<td>For buffered web services:</td>
</tr>
<tr>
<td></td>
<td>■ Most robust usage mode, but requires the most overhead.</td>
</tr>
<tr>
<td></td>
<td>■ Automatically retries message delivery.</td>
</tr>
<tr>
<td></td>
<td>■ Survives network outages.</td>
</tr>
<tr>
<td></td>
<td>■ Enables restart of the source or destination endpoint.</td>
</tr>
<tr>
<td></td>
<td>■ Uses non-anonymous ReplyTo.</td>
</tr>
<tr>
<td></td>
<td>■ Employs asynchronous client transport enabling a single thread to service multiple requests, absorbing load more efficiently. For more information, see Section 12.5, &quot;Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport).&quot;</td>
</tr>
<tr>
<td></td>
<td>■ Web service clients can use asynchronous or synchronous invocation semantics to invoke the web service. For more information, see Table 12–1, “Support for Asynchronous Web Service Invocation”.</td>
</tr>
<tr>
<td></td>
<td>For non-buffered web services:</td>
</tr>
<tr>
<td></td>
<td>■ Less overhead than asynchronous, buffered usage mode.</td>
</tr>
<tr>
<td></td>
<td>■ Persists sequence state only.</td>
</tr>
<tr>
<td></td>
<td>■ Uses non-anonymous ReplyTo.</td>
</tr>
<tr>
<td></td>
<td>■ Web service clients can use asynchronous or synchronous invocation semantics to invoke the web service. For more information, see Table 12–1, “Support for Asynchronous Web Service Invocation’.</td>
</tr>
<tr>
<td>Synchronous transport</td>
<td>■ Offers the least overhead and simplest programming model.</td>
</tr>
<tr>
<td></td>
<td>■ Uses anonymous ReplyTo.</td>
</tr>
<tr>
<td></td>
<td>■ Web service clients can use asynchronous or synchronous invocation semantics to invoke the web service. For more information, see Table 12–1, “Support for Asynchronous Web Service Invocation’.</td>
</tr>
<tr>
<td></td>
<td>■ If a web service client invokes a buffered web service using synchronous transport, one of following will result:</td>
</tr>
<tr>
<td></td>
<td>■ If this is the first request of the sequence, the destination sequence will be set to be non-buffered (as though the web service configuration was set as non-buffered).</td>
</tr>
<tr>
<td></td>
<td>■ If this is not the first request of the sequence (that is, the client sent a request using asynchronous transport previously), then the request is rejected and a fault returned.</td>
</tr>
</tbody>
</table>

### 14.1.3 The Life Cycle of the Reliable Message Sequence

The following figure shows a one-way reliable message exchange.
A reliable message sequence is used to track the progress of a set of messages that are exchanged reliably between an RM source and RM destination. A sequence can be used to send zero or more messages, and is identified by a string identifier. This identifier is used to reference the sequence when using reliable messaging.

The web service client application sends a message for reliable delivery which is transmitted by the RM source to the RM destination. The RM destination acknowledges that the reliable message has been received and delivers it to the web service application. The message may be retransmitted by the RM source until the acknowledgement is received. The RM destination, if configured to buffer requests, may redeliver the request to the web service if the web service fails to process the request.

A web service client sends messages to a target web service by invoking methods on the client instance (port or Dispatch instance). A port is associated with the port type of the reliable web service and represents a programmatic interface to that service. The port is created by the `<clientgen>` child element of the `jwsc` Ant task. A Dispatch instance is a loosely-typed, general-purpose interface for delivering whole messages from the client to the web service. For more information about Dispatch clients, see Section 24.6, "Developing a Web Service Dispatch Client."

WebLogic stores the identifier for the reliable message sequence within this client instance. This causes the reliable message sequence to be connected to a single client instance. All messages that are sent using a given client instance will use the same reliable messaging sequence, regardless of the number of messages that are sent. (Unless you using batching, as described in Section 14.11, "Grouping Messages into Business Units of Work (Batching)."

Because WebLogic Server retains resources associated with the reliable sequence, it is recommended that you take steps to release these resources in a timely fashion. this can be done by managing the lifecycle of the client instance itself, or by using the `weblogic.wsee.reliability2.api.WsrmClient` API. Use the `WsrmClient` API to perform common tasks such as set configuration options, get the sequence id, and terminate a reliable sequence. For more information, see Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence."

### 14.1.4 Reliable Messaging Failure Recovery Scenarios

The following sections outline reliable messaging failure recovery for various scenarios.
Overview of Web Services Reliable Messaging

- Section 14.1.4.1, "RM Destination Down Before Request Arrives"
- Section 14.1.4.2, "RM Source Down After Request is Made"
- Section 14.1.4.3, "RM Destination Down After Request Arrives"
- Section 14.1.4.4, "Failure Scenarios with Non-buffered Reliable Web Services"

The first three scenarios assume that buffering is enabled on both the web service and client. The last scenario describes reliable messaging failure recovery for non-buffered web services. Buffering is enabled on web service client by default. To configure buffering on the web service, see Chapter 22, "Configuring Message Buffering for Web Services."

14.1.4.1 RM Destination Down Before Request Arrives

Table 14–3 describes the reliable messaging failure recovery scenario when an RM destination is unavailable before a request from the RM source arrives.

It is assumed that web service buffering is enabled on both the web service and client. Buffering is enabled on web service client by default. To configure buffering on the web service, see Chapter 22, "Configuring Message Buffering for Web Services."
Table 14–3 Reliable Messaging Failure Recovery Scenario—RM Destination Down Before Request Arrives

<table>
<thead>
<tr>
<th>Transport Type</th>
<th>Scenario Description</th>
</tr>
</thead>
</table>
2. Reliable messaging runtime accepts the request; client returns to do other work.  
3. Reliable messaging runtime attempts to deliver the request and fails because the RM destination is down.  
4. Reliable messaging runtime waits for the retry interval and tries to send the request again. The request delivery fails again.  
5. RM destination comes up.  
6. Reliable messaging runtime waits for the retry interval and tries to send the request again. The request delivery succeeds.  
7. Acknowledgement is sent to the client which includes the message number of the request. The reliable messaging runtime removes the message from the retry list.  
8. Response arrives and the client processes it.  
Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence". |
| Synchronous Transport     | 1. Client invokes a synchronous method.  
2. Reliable messaging runtime accepts the request and blocks the client thread.  
3. Reliable messaging runtime attempts to deliver the request and fails because the RM destination is down.  
4. Reliable messaging runtime waits for the retry interval and tries to send the request again. The request delivery fails again.  
5. RM destination comes up.  
6. Reliable messaging runtime waits for the retry interval and tries to send the request again. The request delivery succeeds.  
7. Response and acknowledgement are sent to the client via the transport back-channel. The acknowledgement includes the message number of the request. The reliable messaging runtime removes the message from the retry list.  
8. Reliable messaging runtime unblocks the client thread and returns the response.  
9. Client receives the response as the return value of the method invocation, and processes the response.  
Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence".  
Note: To achieve true reliability with synchronous transport, it is recommended that you use Make Connection. For more information, see Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)." |

14.1.4.2 RM Source Down After Request is Made

Table 14–4 describes the reliable messaging failure recovery scenario when an RM source goes down after a request is made.

It is assumed that web service buffering is enabled on both the web service and client. Buffering is enabled on web service clients by default. To configure buffering on the web service, see Chapter 22, "Configuring Message Buffering for Web Services."
Table 14–4 Reliable Messaging Failure Recovery Scenario—RM Source Down After Request is Made

<table>
<thead>
<tr>
<th>Transport Type</th>
<th>Scenario Description</th>
</tr>
</thead>
</table>
2. Reliable messaging runtime accepts the request; client returns to do other work.  
3. Client (RM source) goes down.  
4. Client comes up. Client must re-initialize the client instance using the same client ID. The runtime will use this client ID to retrieve the reliable sequence ID that was active for the client. For more information, see Section 14.9.2, "Managing the Client ID".  
5. Reliable messaging runtime detects the reliable sequence ID that was in use prior to the client going down and recovers the accepted requests.  
   Note: This step is accomplished only after the client re-initializes the client instance that was used to send the request because delivery of the request depends on resources provided by the client instance. It is recommended that clients initialize the client instance in a static block, or use a @PostConstruct annotation or other mechanism to ensure early initialization of the client instance. For more information, see the best practices examples presented in Chapter 11, "Roadmap for Developing Asynchronous Web Service Clients."  
6. Reliable messaging runtime sends the request and succeeds.  
7. Acknowledgement is sent to the client which includes the message number of the request. The reliable messaging runtime removes the message from the retry list.  
8. Response arrives and the client processes it.  
   Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence". |
| Synchronous Transport     | 1. Client invokes a synchronous method.  
2. Reliable messaging runtime accepts the request and blocks the client thread.  
3. Reliable messaging runtime attempts to deliver the request. The request delivery succeeds.  
4. Before response can be sent, the client (RM source) goes down. Client thread is lost as the VM exits, along with the invocation state and calling stack of the client itself.  
5. Client (RM source) comes up. Client must re-initialize the client instance (port or Dispatch) using the same client ID. For more information, see Section 14.9.2, "Managing the Client ID"  
6. Reliable messaging runtime detects the previous sequence ID for the client, and sees that the last request was made synchronously.  
7. Reliable messaging runtime delivers a permanent failure notification for this request, and fails the entire RM sequence associated with the client instance. Any ReliabilityErrorListener associated with the client instance will be called at this point.  
8. Client is responsible for retrieving the original request (via some client-specific mechanism) and resending it by re-invoking the client instance with the request.  
   Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence".  
   Note: To achieve true reliability with synchronous transport, it is recommended that you use Make Connection. For more information, see Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)". |
14.1.4.3 RM Destination Down After Request Arrives

Table 14–5 describes the reliable messaging failure recovery scenario when an RM destination is unavailable after a request has been accepted from the RM source.

It is assumed that web service buffering is enabled on both the web service and client. Buffering is enabled on web service client by default. To configure buffering on the web service, see Chapter 22, “Configuring Message Buffering for Web Services.”
Table 14–5  Reliable Messaging Failure Recovery Scenario—RM Destination Down After Request Arrives

<table>
<thead>
<tr>
<th>Transport Type</th>
<th>Scenario Description</th>
</tr>
</thead>
</table>
2. Reliable messaging runtime accepts the request; client returns to do other work.  
3. Reliable messaging runtime attempts to deliver the request and succeeds.  
4. The RM destination accepts the request and send an acknowledgement on the back channel.  
5. Reliable messaging runtime sees the acknowledgement and removes the message from the retry list.  
6. RM destination goes down.  
7. Reliable messaging runtime on RM source retries any pending requests during this time.  
8. RM destination comes up.  
9. RM destination recovers the stored request, processes it, and sends the response.  
10. Response arrives and the client processes it.  
Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence". |
| Synchronous Transport | Note: If you attempt to invoke a buffered web service using synchronous transport, one of following will result:  
- If this is the first request of the sequence, the destination sequence will be set to be non-buffered (as though the web service configuration was set as non-buffered).  
- If this is not the first request of the sequence (that is, the client sent a request using asynchronous transport previously), then the request is rejected and a fault returned.  
The following describes the sequence of this scenario:  
1. Client invokes a synchronous method.  
2. Reliable messaging runtime accepts the request and blocks the client thread.  
3. Reliable messaging runtime attempts to deliver the request. The request delivery succeeds.  
4. RM destination accepts the request and sends an acknowledgement via the transport back channel.  
5. Client (RM source) detects the acknowledgement and removes the request from the retry list.  
6. RM destination goes down.  
7. Client thread remains blocked.  
8. RM Destination comes up, recovers, and processes the request, and sends the response to the client.  
9. Reliable messaging runtime unblocks the client thread and returns the response.  
10. Client receives the response as the return value of the method invocation, and processes the response.  
Note: At any time, the client can check acknowledgement status, access information about a message, and so on, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence". |
14.1.4.4 Failure Scenarios with Non-buffered Reliable Web Services

A non-buffered web service operates differently than a buffered web service in that it does not buffer a request to hardened storage before acknowledging it and attempting to process it. A non-buffered web service will not attempt to reprocess a request if the service logic fails, whereas a buffered web service will attempt to reprocess the request. In both cases, buffered or non-buffered, any response generated by the web service will be buffered before it is sent back to the client.

A non-buffered web service may be useful in the following cases:

■ Web service operates against non-transactional resources and should not process any request more than once (because rolling back the transaction that dequeued the buffered request cannot roll back the side effects of the non-transactional service).

■ Web service is relatively light weight, and does not take very long to process requests.

■ Web service performance is of paramount importance and risk of losing request or response is acceptable. Non-buffered web services will not incur the overhead of buffering the request to a store, and thus can deliver better throughput than a buffered web service. The performance gain is dependent on how much time and resources are required to buffer the requests (for example, very large request messages may take significant time and resources to buffer).

A non-buffered web service is operationally similar to a buffered web service in most failure scenarios. The exceptions are cases where the service (RM destination) itself fails. For example, in all the RM source failure scenarios described, the behavior is the same for a buffered or a non-buffered web service (RM destination). For non-buffered web services the failure window is open between the following two points:

■ The request is accepted for processing.

■ The response from the web service is registered for delivery to the client (RM source).

If the web service (RM destination) fails between these two points, the RM source will assume the request has been successfully processed (since it has been acknowledged) but will never receive a response, and the request may never have been processed.

Carefully consider this failure window before configuring a web service to run as non-buffered.

14.2 Steps to Create and Invoke a Reliable Web Service

Configuring reliable messaging for a WebLogic web service requires standard JMS tasks such as creating JMS servers and Store and Forward (SAF) agents, as well as web service-specific tasks, such as adding additional JWS annotations to your JWS file. Optionally, you create custom WS-Policy files that describe the reliable messaging capabilities of the reliable web service if you do not use the pre-packaged ones.

If you are using the WebLogic client APIs to invoke a reliable web service, the client application must run on WebLogic Server. Thus, configuration tasks must be performed on both the source WebLogic Server instance on which the web service client code is deployed, as well as the destination WebLogic Server instance on which the reliable web service itself is deployed.

Table 14–6 summarizes the steps to create a reliable web service and a client that invokes an operation of the reliable web service. The procedure describes how to create the JWS files that implement the web service and client from scratch; if you
want to update existing JWS files, use this procedure as a guide. The procedure also
describes how to configure the source and destination WebLogic Server instances.

It is assumed that you have completed the following tasks:

- You have created the destination and source WebLogic Server instances. You deploy
  the reliable web service to the destination WebLogic Server instance, and the client
  that invokes the reliable web service to the source WebLogic Server instance.
- You have set up an Ant-based development environment.
- You have working build.xml files that you can edit, for example, to add targets
  for running the jwsc Ant task and deploying the generated reliable web service.

For more information, see Chapter 3, "Developing JAX-WS Web Services." For best
practices for developing asynchronous and reliable web services and clients, see
Section 13, "Roadmap for Developing Reliable Web Services and Clients".

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Configure the destination and source WebLogic Server instances.</td>
<td>You deploy the reliable web service to the destination WebLogic Server instance, and the client&lt;br&gt;that invokes the reliable web service to the source WebLogic Server instance. For information about configuring the destination WebLogic Server instance, see Section 14.3, &quot;Configuring the Source and Destination WebLogic Server Instances.&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Create the WS-Policy file. (Optional)</td>
<td>Using your favorite XML or plain text editor, optionally create a WS-Policy file that describes the reliable messaging capabilities of the web service running on the destination WebLogic Server. For details about creating your own WS-Policy file, see Section 14.4, &quot;Creating the Web Service Reliable Messaging WS-Policy File.&quot;&lt;br&gt;Note: This step is not required if you plan to use one of the WS-Policy files that are included in WebLogic Server; see Appendix A, &quot;Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection&quot; for more information.</td>
</tr>
<tr>
<td>3</td>
<td>Create or update the JWS file that implements the reliable web service.</td>
<td>This web service will be deployed to the destination WebLogic Server instance. See Section 14.5, &quot;Programming Guidelines for the Reliable JWS File.&quot;&lt;br&gt;For examples demonstrating best practices, see Section 13, &quot;Roadmap for Developing Reliable Web Services and Clients.&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Update the build.xml file that is used to compile the reliable web services.</td>
<td>Update your build.xml file to include a call to the jwsc Ant task which will compile the reliable JWS file into a web service.&lt;br&gt;See Section 3.6, &quot;Running the jwsc WebLogic Web Services Ant Task.&quot; for general information about using the jwsc task.</td>
</tr>
<tr>
<td>5</td>
<td>Compile and deploy the reliable JWS file.</td>
<td>Compile the reliable JWS file by calling the appropriate target and deploy to the destination WebLogic Server. For example:&lt;br&gt;prompt&gt; ant build-reliableService deploy-reliableService</td>
</tr>
<tr>
<td>6</td>
<td>Create or update the web service client.</td>
<td>The web service client invokes the reliable web service and will be deployed to the source WebLogic Server. See Section 14.6, &quot;Invoking a Reliable Web Service from a Web Service Client&quot;.</td>
</tr>
<tr>
<td>7</td>
<td>Configure reliable messaging. (Optional)</td>
<td>Configure reliable messaging for the reliable web service using the WebLogic Server Administration Console. The WS-Policy file attached to the reliable web service provides the initial configuration settings. See Section 14.7, &quot;Configuring Reliable Messaging&quot;.</td>
</tr>
<tr>
<td>8</td>
<td>Implement a reliability error listener. (Optional)</td>
<td>Implement a reliability error listener to receive notifications if a reliable delivery fails. See Section 14.8, &quot;Implementing the Reliability Error Listener&quot;.</td>
</tr>
</tbody>
</table>
Each of these steps is described in more detail in the following sections. In addition, the following topics are discussed:

- **Section 14.11, “Grouping Messages into Business Units of Work (Batching)”**—Describes how to group messages into business units of work—also called batching—to improve performance when using reliable messaging.
- **Section 14.12, “Client Considerations When Redeploying a Reliable Web Service”**—Describes client considerations for when you deploy a new version of an updated reliable WebLogic web service alongside an older version of the same web service.
- **Section 14.13, “Interoperability with WebLogic Web Service Reliable Messaging”**—Provides recommendations for interoperating with WebLogic web services reliable messaging.

### 14.3 Configuring the Source and Destination WebLogic Server Instances

You need to configure web service persistence on the destination and source WebLogic Server instances. You deploy the reliable web service to the destination WebLogic Server instance, and the client that invokes the reliable web service to the source WebLogic Server instance.

When using web services reliable messaging, the web services reliable messaging sequence is saved to the web service persistent store any time its state changes. Examples of state change include:

- Reliable messaging state is updated (creating, created, terminating, terminated, and so on).
- Security property is updated (such as security context token)
- Message is sent on the reliable messaging sequence (if message buffering is enabled)
- Acknowledgement when a message arrives

You can configure web service persistence using the Configuration Wizard to extend the WebLogic Server domain using a web services-specific extension template.
Alternatively, you can configure the resources required for these advanced features using the Oracle WebLogic Server Administration Console or WLST. For information about configuring web service persistence, see Section 21.3, "Configuring Web Service Persistence."

You may also wish to configure buffering for web services. For considerations and steps to configure message buffering, see Chapter 22, "Configuring Message Buffering for Web Services."

14.4 Creating the Web Service Reliable Messaging WS-Policy File

A WS-Policy file is an XML file that contains policy assertions that comply with the WS-Policy specification. In this case, the WS-Policy file contains web service reliable messaging policy assertions.

WebLogic Server includes pre-packaged WS-Policy files that contain typical reliable messaging assertions that you can use if you do not want to create your own WS-Policy file.

The pre-packaged WS-Policy files are listed in the following table. This table also specifies whether the WS-Policy file can be attached at the method level; if the value in this column is no, then the WS-Policy file can be attached at the class level only. For more information, see Appendix A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection".

Note: The DefaultReliability.xml and LongRunningReliability.xml files are deprecated in this release. Use of the DefaultReliability1.2.xml, Reliability1.2_ SequenceTransportSecurity, or Reliability1.0_1.2.xml file is recommended and required to comply with the 1.2 version of the WS-ReliableMessaging specification at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.2-spec-os.pdf.

<table>
<thead>
<tr>
<th>Pre-packaged WS-Policy File</th>
<th>Description</th>
<th>Method Level Attachment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>DefaultReliability1.2.xml</td>
<td>Specifies policy assertions related to delivery assurance. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.2, &quot;DefaultReliability1.1.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>DefaultReliability1.1.xml</td>
<td>Specifies policy assertions related to quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp</a> -1.1-spec-os-01.html. See Section A.2, &quot;DefaultReliability1.1.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>Reliability1.2_ExactlyOnce_ WithMC1.1.xml</td>
<td>Specifies policy assertions related to quality of service. It enables Make Connection support on the web service and specifies usage as optional on the web service client. See Section A.7, &quot;Reliability1.2_ ExactlyOnce_ WithMC1.1.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 14–7  (Cont.) Pre-packaged WS-Policy Files That Support Reliable Messaging

<table>
<thead>
<tr>
<th>Pre-packaged WS-Policy File</th>
<th>Description</th>
<th>Method Level Attachment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability1.2_SequenceSTRSecurity</td>
<td>Specifies that in order to secure messages in a reliable sequence, the runtime will use the wsse:SecurityTokenReference that is referenced in the CreateSequence message. It enables Make Connection support on the web service and specifies usage as optional on the web service client. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.10, &quot;Reliability1.2_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
<tr>
<td>Reliability1.1_SequenceSTRSecurity</td>
<td>The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html</a>. See Section A.11, &quot;Reliability1.1_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>Reliability1.2_SequenceTransportSecurity</td>
<td>Specifies policy assertions related to transport-level security and quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.10, &quot;Reliability1.2_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>Reliability1.1_SequenceTransportSecurity</td>
<td>Specifies policy assertions related to transport-level security and quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html</a>. See Section A.11, &quot;Reliability1.1_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>Reliability1.0_1.2.xml</td>
<td>Combines 1.2 and 1.0 WS-Reliable Messaging policy assertions. The policy assertions for the 1.2 version Make Connection support on the web service and specifies usage as optional on the web service client. This sample relies on smart policy selection to determine the policy assertion that is applied at runtime. See Section A.12, &quot;Reliability1.0_1.2.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
</tbody>
</table>
Creating the Web Service Reliable Messaging WS-Policy File

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You can use one of the pre-packaged reliable messaging WS-Policy files included in WebLogic Server; these files are adequate for most use cases. You cannot modify the pre-packaged files. If the values do not suit your needs, you must create a custom WS-Policy file. The following sections describe how to create a custom WS-Policy file.

- Section 14.4.1, "Creating a Custom WS-Policy File Using WS-ReliableMessaging Policy Assertions Versions 1.2 and 1.1"
- Section 14.4.2, "Creating a Custom WS-Policy File Using WS-ReliableMessaging Policy Assertions Version 1.0 (Deprecated)"
- Section 14.4.3, "Using Multiple Policy Alternatives"

14.4.1 Creating a Custom WS-Policy File Using WS-ReliableMessaging Policy Assertions Versions 1.2 and 1.1

This section describes how to create a custom WS-Policy file that contains web service reliable messaging assertions that are based on the following specifications:


The root element of the WS-Policy file is <Policy> and it should include the following namespace declaration:

```xml
<wsp:Policy
```

Table 14–7 (Cont.) Pre-packaged WS-Policy Files That Support Reliable Messaging

<table>
<thead>
<tr>
<th>Pre-packaged WS-Policy File</th>
<th>Description</th>
<th>Method Level Attachment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability1.0_1.1.xml</td>
<td>Combines 1.1 and 1.0 WS Reliable Messaging policy assertions. See Section A.13, &quot;Reliability1.0_1.1.xml (WS-Policy.xml File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>DefaultReliability.xml</td>
<td><strong>Deprecated.</strong> The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 at <a href="http://schemas.xmlsoap.org/ws/2005/02/rm/WS-RMPolicy.pdf">http://schemas.xmlsoap.org/ws/2005/02/rm/WS-RMPolicy.pdf</a>. In this release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration. Specifies typical values for the reliable messaging policy assertions, such as inactivity timeout of 10 minutes, acknowledgement interval of 200 milliseconds, and base retransmission interval of 3 seconds. See Section A.3, &quot;DefaultReliability.xml WS-Policy File (WS-Policy) [Deprecated]&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>LongRunningReliability.xml</td>
<td><strong>Deprecated.</strong> The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 for long running processes. In this release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration. Similar to the preceding default reliable messaging WS-Policy file, except that it specifies a much longer activity timeout interval (24 hours.) See Section A.4, &quot;LongRunningReliability.xml WS-Policy File (WS-Policy) [Deprecated]&quot;.</td>
<td>Yes</td>
</tr>
</tbody>
</table>
You wrap all web service reliable messaging policy assertions inside of a `<wsrm:RMAssertion>` element. This element should include the following namespace declaration for using web service reliable messaging policy assertions:

```xml
<wsmo:RMAssertion
 xmlns:wsmo="http://docs.oasis-open.org/ws-rx/wsmo/200702">
```

The following table lists the web service reliable messaging assertions that you can specify in the WS-Policy file. The order in which the assertions appear is important. You can specify the following assertions; the order they appear in the following list is the order in which they should appear in your WS-Policy file:

<table>
<thead>
<tr>
<th>Assertion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;wsrm:SequenceSTR&gt;</code></td>
<td>To secure messages in a reliable sequence, the runtime will use the wss:SecurityTokenReference that is referenced in the CreateSequence message. You can only specify one security assertion; that is, you can specify <code>wsrm:SequenceSTR</code> or <code>wsrm:SequenceTransportSecurity</code>, but not both.</td>
</tr>
<tr>
<td><code>&lt;wsrm:SequenceTransportSecurity&gt;</code></td>
<td>To secure messages in a reliable sequence, the runtime will use the SSL transport session that is used to send the CreateSequence message. This assertion must be used in conjunction with the sp:TransportBinding assertion that requires the use of some transport-level security mechanism (for example, sp:HttpsToken). You can only specify one security assertion; that is, you can specify <code>wsrm:SequenceSTR</code> or <code>wsrm:SequenceTransportSecurity</code>, but not both.</td>
</tr>
<tr>
<td><code>&lt;wsrm:DeliveryAssurance&gt;</code></td>
<td>Delivery assurance (or quality of service) of the web service. Valid values are AtMostOnce, AtLeastOnce, ExactlyOnce, and InOrder. You can set one of the delivery assurances defined in the following table. If not set, the delivery assurance defaults to ExactlyOnce. For more information about delivery assurance, see Table 14–1.</td>
</tr>
</tbody>
</table>

The following example shows a simple web service reliable messaging WS-Policy file:

```xml
<?xml version="1.0"?>
  <wsrm:RMAssertion
    xmlns:wsrm="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
    <wsrm:SequenceTransportSecurity/>
    <wsrm:DeliveryAssurance>
      <wsp:Policy>
        <wsrm:ExactlyOnce/>
      </wsp:Policy>
    </wsrm:DeliveryAssurance>
  </wsrm:RMAssertion>
</wsp:Policy>
```

For more information about Reliable Messaging policy assertions in the WS-Policy file, see "Web Service Reliable Messaging Policy Assertion Reference" in WebLogic Web Services Reference for Oracle WebLogic Server.
14.4.2 Creating a Custom WS-Policy File Using WS-ReliableMessaging Policy Assertions Version 1.0 (Deprecated)

This section describes how to create a custom WS-Policy file that contains web service reliable messaging assertions that are based on WS Reliable Messaging Policy Assertion Version 1.0 at http://schemas.xmlsoap.org/ws/2005/02/rm/WS-RMPolicy.pdf.

Note: Many of the reliable messaging policy assertions described in this section are managed through JWS annotations or configuration.

The root element of the WS-Policy file is <Policy> and it should include the following namespace declarations for using web service reliable messaging policy assertions:

```xml
<wsp:Policy
 xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm"
 xmlns:beapolicy="http://www.bea.com/wsrm/policy">
```

You wrap all web service reliable messaging policy assertions inside of a `<wsrm:RMAssertion>` element. The assertions that use the `wsrm:` namespace are standard ones defined by the WS-ReliableMessaging specification at http://docs.oasis-open.org/ws-rx/wsrm/200702/wsrm-1.1-spec-os-01.pdf. The assertions that use the `beapolicy:` namespace are WebLogic-specific. See "Web Service Reliable Messaging Policy Assertion Reference" in the WebLogic Web Services Reference for Oracle WebLogic Server for details.

The following table lists the web service reliable messaging assertions that you can specify in the WS-Policy file. All web service reliable messaging assertions are optional, so only set those whose default values are not adequate. The order in which the assertions appear is important. You can specify the following assertions; the order they appear in the following list is the order in which they should appear in your WS-Policy file,

<table>
<thead>
<tr>
<th>Assertion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;wsrm:InactivityTimeout&gt;</code></td>
<td>Number of milliseconds, specified with the <code>Milliseconds</code> attribute, which defines an inactivity interval. After this amount of time, if the destination endpoint has not received a message from the source endpoint, the destination endpoint may consider the sequence to have terminated due to inactivity. The same is true for the source endpoint. By default, sequences never timeout.</td>
</tr>
<tr>
<td><code>&lt;wsrm:BaseRetransmissionInterval&gt;</code></td>
<td>Interval, in milliseconds, that the source endpoint waits after transmitting a message and before it retransmits the message if it receives no acknowledgment for that message. Default value is set by the SAF agent on the source endpoint's WebLogic Server instance.</td>
</tr>
<tr>
<td><code>&lt;wsrm:ExponentialBackoff&gt;</code></td>
<td>Specifies that the retransmission interval will be adjusted using the exponential backoff algorithm. This element has no attributes.</td>
</tr>
</tbody>
</table>
Creating the Web Service Reliable Messaging WS-Policy File

The following example shows a simple web service reliable messaging WS-Policy file:

```xml
<?xml version="1.0"?>
<wsp:Policy
  xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm/policy"
  xmlns:beapolicy="http://www.bea.com/wsrm/policy"/>
<wrm:RMAssertion>
  <wsrm:InactivityTimeout
    Milliseconds="600000" />
  <wsrm:BaseRetransmissionInterval
    Milliseconds="500" />
  <wsrm:ExponentialBackoff />
  <wsrm:AcknowledgementInterval
    Milliseconds="2000" />
</wrm:RMAssertion>
</wsp:Policy>
```

For more information about reliable messaging policy assertions in the WS-Policy file, see "Web Service Reliable Messaging Policy Assertion Reference" in WebLogic Web Services Reference for Oracle WebLogic Server.

14.4.3 Using Multiple Policy Alternatives

You can configure multiple policy alternatives—also referred to as smart policy alternatives—for a single web service by creating a custom policy file. At runtime, WebLogic Server selects which of the configured policies to apply. It excludes policies that are not supported or have conflicting assertions and selects the appropriate policy, based on your configured preferences, to verify incoming messages and build the response messages.

The following example provides an example of a security policy that supports both 1.2 and 1.0 WS-Reliable Messaging. Each policy alternative is enclosed in a `<wsp:All>` element.

<table>
<thead>
<tr>
<th>Assertion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;wsrm:AcknowledgmentInterval&gt;</code></td>
<td>Maximum interval, in milliseconds, in which the destination endpoint must transmit a standalone acknowledgement. The default value is set by the SAF agent on the destination endpoint's WebLogic Server instance.</td>
</tr>
<tr>
<td><code>&lt;beapolicy:Expires&gt;</code></td>
<td>Amount of time after which the reliable web service expires and does not accept any new sequence messages. The default value is to never expire. The element has a single attribute, Expires, whose data type is an XML Schema duration type (see <a href="http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/#duration">http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/#duration</a>). For example, if you want to set the expiration time to one day, use the following: <code>&lt;beapolicy:Expires Expires=&quot;P1D&quot; /&gt;</code>.</td>
</tr>
<tr>
<td><code>&lt;beapolicy:QOS&gt;</code></td>
<td>Delivery assurance level, as described in Table 14-1. The element has one attribute, QOS, which you set to one of the following values: AtMostOnce, AtLeastOnce, or ExactlyOnce. You can also include the InOrder string to specify that the messages be in order. The default value is ExactlyOnce InOrder. This element is typically not set.</td>
</tr>
</tbody>
</table>

The following example provides a simple web service reliable messaging WS-Policy file:

```xml
<?xml version="1.0"?>
<wsp:Policy
  xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm/policy"
  xmlns:beapolicy="http://www.bea.com/wsrm/policy"/>
<wrm:RMAssertion>
  <wsrm:InactivityTimeout
    Milliseconds="600000" />
  <wsrm:BaseRetransmissionInterval
    Milliseconds="500" />
  <wsrm:ExponentialBackoff />
  <wsrm:AcknowledgementInterval
    Milliseconds="2000" />
</wrm:RMAssertion>
</wsp:Policy>
```
14.5 Programming Guidelines for the Reliable JWS File

**Note:** For best practices for developing reliable web services, see Chapter 13, "Roadmap for Developing Reliable Web Services and Clients."

Use the @Policy annotation in your JWS file to specify that the web service has a WS-Policy file attached to it that contains reliable messaging assertions. WebLogic Server delivers a set of pre-packaged WS-Policy files, as described in Appendix A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection".

Follow the following guidelines when using the @Policy annotation for web service reliable messaging:

- Use the `uri` attribute to specify the build-time location of the policy file, as follows:
  - If you have created your own WS-Policy file, specify its location relative to the JWS file. For example:
    ```java
    @Policy(uri="ReliableHelloWorldPolicy.xml",
            direction=Policy.Direction.both,
            attachToWsdl=true)
    ```

For more information about multiple policy alternatives, see "Smart Policy Selection" in *Securing WebLogic Web Services for Oracle WebLogic Server*. 

```xml
  <wsp:ExactlyOne>
    <wsp:All>
      <wsrmp10:RMAssertion
        xmlns:wsrmp10="http://schemas.xmlsoap.org/ws/2005/02/rm/policy">
        <wsrmp10:InactivityTimeout Milliseconds="1200000"/>
        <wsrmp10:BaseRetransmissionInterval Milliseconds="60000"/>
        <wsrmp10:ExponentialBackoff/>
        <wsrmp10:AcknowledgementInterval Milliseconds="800"/>
      </wsrmp10:RMAssertion>
    </wsp:All>
    <wsp:All>
      <wsrmp:RMAssertion
        xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
        <wsrmp:SequenceSTR/>
        <wsrmp:DeliveryAssurance>
          <wsp:Policy>
            <wsrmp:AtMostOnce/>
          </wsp:Policy>
        </wsrmp:DeliveryAssurance>
      </wsrmp:RMAssertion>
    </wsp:All>
  </wsp:ExactlyOne>
</wsp:Policy>
```
In this example, the `ReliableHelloWorldPolicy.xml` file is located in the same directory as the JWS file.

- To specify one of the pre-packaged WS-Policy files or a WS-Policy file that is packaged in a shared Java EE library, use the `policy:` prefix along with the name and path of the policy file. This syntax tells the `jwsc` Ant task at build-time not to look for an actual file on the file system, but rather, that the web service will retrieve the WS-Policy file from WebLogic Server at the time the service is deployed.

**Note:** Shared Java EE libraries are useful when you want to share a WS-Policy file with multiple web services that are packaged in different Enterprise applications. As long as the WS-Policy file is located in the `META-INF/policies` or `WEB-INF/policies` directory of the shared Java EE library, you can specify the policy file in the same way as if it were packaged in the same archive at the web service. See "Creating Shared Java EE Libraries and Optional Packages" in Developing Applications for Oracle WebLogic Server for information about creating libraries and setting up your environment so the web service can locate the policy files.

- To specify that the policy file is published on the Web, use the `http:` prefix along with the URL, as shown in the following example:

```java
@Policy(url="http://someSite.com/policies/mypolicy.xml"
        direction=Policy.Direction.both,
        attachToWsdl=true)
```

- By default, WS-Policy files are applied to both the request (inbound) and response (outbound) SOAP messages. You can change this default behavior with the `direction` attribute by setting the attribute to `Policy.Direction.inbound` or `Policy.Direction.outbound`.

- You can specify whether the web service requires the operations to be invoked reliably and have the responses delivered reliably using the `wsp:optional` attribute within the policy file specified by `uri`.

Please note:

- If the client uses synchronous transport to invoke a web service, and the inbound direction of the operation requires reliability (optional attribute is `false`), the client must provide an offer sequence (`<wsrm: Offer...>`) as described in the WS-ReliableMessaging specification at [http://docs.oasis-open.org/ws-rx/wsrxml/200702/wsrxml-1.1-spec-os-01.pdf](http://docs.oasis-open.org/ws-rx/wsrxml/200702/wsrxml-1.1-spec-os-01.pdf) for use when sending reliable responses.

- If the client uses asynchronous transport, the client is not required to send an offer sequence. If a request is made reliably, and the outbound direction has any RM policy (optional or not), the reliable messaging runtime will enforce the handshaking of a new RM sequence for sending the response. This new sequence will be associated with the request sequence, and all responses from that point onward are sent on the new response sequence. The response sequence is negotiated with the endpoint indicated by the ReplyTo address of the request.

- Set the `attachToWsdl` attribute of the `@Policy` annotation to specify whether the policy file should be attached to the WSDL file that describes the public contract of the web service. Typically, you want to publicly publish the policy so that client
applications know the reliable messaging capabilities of the web service. For this reason, the default value of this attribute is true.

For more information about the @Policy annotation, see “weblogic.jws.Policy” in WebLogic Web Services Reference for Oracle WebLogic Server.

Example 14–1 shows a simple JWS file that implements a reliable web service.

**Example 14–1 Example of a Reliable Web Service**

```java
import javax.jws.WebService;
import weblogic.jws.Policies;
import weblogic.jws.Policy;

/**
 * Example web service for reliable client best practice examples
 */
@WebService
// Enable RM on this service.
@Policies( { @Policy(uri = "policy:DefaultReliability1.2.xml") })
public class BackendReliableService {

    public String doSomething(String what) {

        System.out.println("BackendReliableService doing: " + what);

        return "Did (Reliably) '" + what + '" at: ' + System.currentTimeMillis();
    }
}
```

In the example, the predefined DefaultReliability1.2.xml policy file is attached to the web service at the class level, which means that the policy file is applied to all public operations of the web service—the doSomething() operation can be invoked reliably. The policy file is applied to both request and response by default. For information about the pre-packaged policies available and creating a custom policy, see Section 14.4, "Creating the Web Service Reliable Messaging WS-Policy File”.

14.6 Invoking a Reliable Web Service from a Web Service Client

**Note:** For best practices for developing reliable web service clients, see Section 13.1, “Roadmap for Developing Reliable Web Service Clients.”

The following table summarizes how to invoke a reliable web service from a web service client based on the transport type that you want to employ. For a description of transport types, see Table 14–2.
For additional control on the client side, you may wish to perform one or more of the following tasks:

- Configure reliable messaging on the client side, as described in Section 14.7, "Configuring Reliable Messaging".
- Implement the reliability error listener to receive notifications if a reliable delivery fails, as described in Section 14.8, "Implementing the Reliability Error Listener". Oracle recommends that you always implement the reliability error listener as a best practice.
- Perform common life cycle tasks on the reliable messaging sequence, such as set configuration options, get the reliable sequence id, and terminate a reliable sequence, as described in Section 14.9, "Managing the Life Cycle of a Reliable Message Sequence".

### Table 14–10 Invoking a Reliable Web Service Based on Transport Type

<table>
<thead>
<tr>
<th>Transport Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asynchronous transport</td>
<td>To use asynchronous transport, perform the following steps:</td>
</tr>
<tr>
<td></td>
<td>1. Implement the web service client, as described in Table 12–3, &quot;Steps to Invoke Web Services Asynchronously&quot;.</td>
</tr>
<tr>
<td></td>
<td>In step 3 of Table 12–3, implement one of the following transport mechanisms, depending on whether the client is behind a firewall or not:</td>
</tr>
<tr>
<td></td>
<td>- Asynchronous client transport feature, as described in Section 12.5, &quot;Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)&quot;.</td>
</tr>
<tr>
<td></td>
<td>- Make Connection if the client is behind a firewall, as described in Section 12.6, &quot;Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)&quot;.</td>
</tr>
<tr>
<td></td>
<td>2. Invoke the web service using either asynchronous or synchronous invocation semantics.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> You can invoke synchronous operations when asynchronous client transport or Make Connection is enabled, as described in Section 12.5.1.5, &quot;Configuring Asynchronous Client Transport for Synchronous Operations&quot; and Section 12.6.2.4, &quot;Configuring Make Connection as the Transport for Synchronous Methods&quot;.</td>
</tr>
<tr>
<td>Synchronous transport</td>
<td>To use synchronous transport, invoke an asynchronous or synchronous method on the reliable messaging service port instance using the standard JAX-WS Reference Implementation, as described in Section 12.7, &quot;Using the JAX-WS Reference Implementation&quot;.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> If you attempt to invoke a buffered web service using synchronous transport, one of following will result:</td>
</tr>
<tr>
<td></td>
<td>- If this is the first request of the sequence, the destination sequence will be set to be non-buffered (as though the web service configuration was set as non-buffered).</td>
</tr>
<tr>
<td></td>
<td>- If this is not the first request of the sequence (that is, the client sent a request using asynchronous transport previously), then the request is rejected and a fault returned.</td>
</tr>
</tbody>
</table>

For best practices for configuring reliable web services, see Chapter 13, "Roadmap for Developing Reliable Web Services and Clients."
You can configure properties for a reliable web service and client at the WebLogic Server, web service endpoint, or web service client level.

The properties that you define at the WebLogic Server level apply to all reliable web services and clients on that server. For information about configuring reliable messaging at the WebLogic Server level, see Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server".

If desired, you can override the reliable message configuration options defined at the server level, as follows:

- At the web service endpoint level by updating the application deployment plan. The deployment plan associates new values with specific locations in the descriptors for your application, and is stored in the weblogic-webservices.xml descriptor. At deployment time, a deployment plan is merged with the descriptors in the application by applying the values in its variable assignments to the locations in the application descriptors to which the variables are linked. For more information, see Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

- At the web service client level, as described in Section 14.7.3, "Configuring Reliable Messaging on Web Service Clients"

The following sections describe how to configure reliable messaging at the WebLogic Server, web service endpoint, and web service client levels.

- Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
- Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"
- Section 14.7.3, "Configuring Reliable Messaging on Web Service Clients"
- Section 14.7.4, "Configuring the Base Retransmission Interval"
- Section 14.7.5, "Configuring the Retransmission Exponential Backoff"
- Section 14.7.6, "Configuring the Sequence Expiration"
- Section 14.7.7, "Configuring Inactivity Timeout"
- Section 14.7.8, "Configuring a Non-buffered Destination for a Web Service"
- Section 14.7.9, "Configuring the Acknowledgement Interval"
- Section 14.8, "Implementing the Reliability Error Listener"

### 14.7.1 Configuring Reliable Messaging on WebLogic Server

You can configure reliable messaging on WebLogic Server using the WebLogic Server Administration Console or WLST, as described in the following sections.

- Section 14.7.1.1, "Using the Administration Console"
- Section 14.7.1.2, "Using WLST"

#### 14.7.1.1 Using the Administration Console

To configure reliable messaging for WebLogic Server using the WebLogic Server Administration Console:

1. Invoke the WebLogic Server Administration Console, as described in "Using the Administration Console" in Understanding WebLogic Web Services for Oracle WebLogic Server.

2. In the left navigation pane, select Environment, then Servers.
3. Select the **Configuration** tab and in the Server tables, click on the name of the server for which you want to configure reliable messaging.

4. Click the **Configuration** tab, then the **Web Services** tab, then the **Reliable Message** tab.

5. Edit the reliable messaging properties, as described in the following sections:
   - Section 14.7.4.1, "Configuring the Base Retransmission Interval on WebLogic Server or the Web Service Endpoint"
   - Section 14.7.5.1, "Configuring the Retransmission Exponential Backoff on WebLogic Server or Web Service Endpoint"
   - Section 14.7.6.1, "Configuring the Sequence Expiration on WebLogic Server or Web Service Endpoint"
   - Section 14.7.7.1, "Configuring the Inactivity Timeout on WebLogic Server or Web Service Endpoint"
   - Section 14.7.8, "Configuring a Non-buffered Destination for a Web Service"
   - Section 14.7.9, "Configuring the Acknowledgement Interval"

6. Click **Save**.

For more information, see "Web Service Reliable Messaging” in the *Oracle WebLogic Server Administration Console Online Help*.

### 14.7.1.2 Using WLST

Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see “Configuring Existing Domains” in *Understanding the WebLogic Scripting Tool*.

### 14.7.2 Configuring Reliable Messaging on the Web Service Endpoint

By default, web service endpoints use the reliable messaging configuration defined for the server. You can override the reliable messaging configuration used by the web service endpoint using the WebLogic Server Administration Console, as follows:

**Note:** Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see “Configuring Existing Domains” in *Understanding the WebLogic Scripting Tool*.

1. Invoke the WebLogic Server Administration Console, as described in "Invoking the Administration Console" in *Understanding WebLogic Web Services for Oracle WebLogic Server*.
2. In the left navigation pane, select **Deployments**.
3. Click the name of the web service in the Deployments table.
4. Select the **Configuration** tab, then the Port Components tab.
5. Click the name of the web service endpoint in the Ports table.
6. Select the **Reliable Message** tab.
7. Click **Customize Reliable Message Configuration** and follow the instructions to save the deployment plan, if required.
8. Edit the reliable messaging properties, as described in the following sections:

- Section 14.7.4.1, "Configuring the Base Retransmission Interval on WebLogic Server or the Web Service Endpoint"
- Section 14.7.5.1, "Configuring the Retransmission Exponential Backoff on WebLogic Server or Web Service Endpoint"
- Section 14.7.6.1, "Configuring the Sequence Expiration on WebLogic Server or Web Service Endpoint"
- Section 14.7.7.1, "Configuring the Inactivity Timeout on WebLogic Server or Web Service Endpoint"
- Section 14.7.8, "Configuring a Non-buffered Destination for a Web Service"
- Section 14.7.9, "Configuring the Acknowledgement Interval"

9. Click Save.

For more information, see "Configure Web Service Reliable Messaging" in the Oracle WebLogic Server Administration Console Online Help.

14.7.3 Configuring Reliable Messaging on Web Service Clients

For general information about configuring reliable messaging on web service clients, see Section 8.5, " Configuring Web Service Clients."

For information about using the `weblogic.wsee.reliability2.api.WsrmClientInitFeature` when creating a web services reliable messaging client, refer to the following sections:

- Section 14.7.4.2, "Configuring the Base Retransmission Interval on the Web Service Client"
- Section 14.7.5.2, "Configuring the Retransmission Exponential Backoff on the Web Service Client"
- Section 14.7.6.2, "Configuring the Sequence Expiration on the Web Service Client"
- Section 14.7.7.2, "Configuring the Inactivity Timeout on the Web Service Client"

14.7.4 Configuring the Base Retransmission Interval

If the source endpoint does not receive an acknowledgement for a given message within the specified base retransmission interval, the source endpoint retransmits the message. The source endpoint can modify this retransmission interval at any point during the lifetime of the sequence of messages.

This interval can be used in conjunction with the retransmission exponential backoff, described in Section 14.7.5, "Configuring the Retransmission Exponential Backoff", to specify the algorithm that is used to adjust the retransmission interval.

The value specified must be a positive value and conform to the XML schema duration lexical format, \( P^nY^nM^nD^nT^nH^nM^nS^n \), where \( nY \) specifies the number of years, \( nM \) specifies the number of months, \( nD \) specifies the number of days, \( T \) is the date/time separator, \( nH \) specifies the number of hours, \( nM \) specifies the number of minutes, and \( nS \) specifies the number of seconds. This value defaults to \( P^0T^0D^0T^0H^0M^0S^5 \) (5 seconds).

The following sections describe how to configure the base retransmission interval:

- Section 14.7.4.1, "Configuring the Base Retransmission Interval on WebLogic Server or the Web Service Endpoint"
Section 14.7.4.2, "Configuring the Base Retransmission Interval on the Web Service Client"

14.7.4.1 Configuring the Base Retransmission Interval on WebLogic Server or the Web Service Endpoint

To configure the retransmission exponential backoff on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
   - Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the **Base Retransmission Interval** value, as required.

14.7.4.2 Configuring the Base Retransmission Interval on the Web Service Client

**Note:** Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see "Configuring Existing Domains" in *Understanding the WebLogic Scripting Tool*.

**Note:** For more information about configuring web service clients, see Section 8.5, "Configuring Web Service Clients."

Table 14–11 defines that `weblogic.wsee.reliability2.api.WsrmClientInitFeature` methods for configuring the interval of time that must pass before a message is retransmitted to the RM destination.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>String getBaseRetransmissionInterval()</code></td>
<td>Gets the base retransmission interval.</td>
</tr>
<tr>
<td><code>void setBaseRetransmissionInterval(String interval)</code></td>
<td>Sets the base retransmission interval.</td>
</tr>
</tbody>
</table>

In the following example, the base retransmission interval is set to 3 hours.

```java
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
    @WebServiceRef(name="ReliableEchoService")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;
    WsrmClientInitFeature initFeature = new WsrmClientInitFeature(true);
...
The base retransmission interval configuration appears in the weblogic.xml file as follows:

```
<service-reference-description>
  ...
  <port-info>
    <stub-property>
      <name>weblogic.wsee.wsrmi.BaseRetransmissionInterval</name>
      <value>PT30S</value>
    </stub-property>
  ...
</port-info>
</service-reference-description>
```

14.7.5 Configuring the Retransmission Exponential Backoff

The retransmission exponential backoff is used in conjunction with the base retransmission interval, described in Section 14.7.4, "Configuring the Base Retransmission Interval". If a destination endpoint does not acknowledge a sequence of messages for the time interval specified by the base retransmission interval, the exponential backoff algorithm is used for timing successive retransmissions by the source endpoint, should the message continue to go unacknowledged.

The exponential backoff algorithm specifies that successive retransmission intervals should increase exponentially, based on the base retransmission interval. For example, if the base retransmission interval is 2 seconds, and the exponential backoff element is set, successive retransmission intervals if messages continue to go unacknowledged are 2, 4, 8, 16, 32, and so on.

By default, this flag is disabled (false), indicating that the same retransmission interval is used in successive retries; the interval does not increase exponentially.

The following sections describe how to configure the retransmission exponential backoff:

- Section 14.7.5.1, "Configuring the Retransmission Exponential Backoff on WebLogic Server or Web Service Endpoint"
- Section 14.7.5.2, "Configuring the Retransmission Exponential Backoff on the Web Service Client"

14.7.5.1 Configuring the Retransmission Exponential Backoff on WebLogic Server or Web Service Endpoint

To configure the retransmission exponential backoff on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

---

Note: Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see "Configuring Existing Domains" in Understanding the WebLogic Scripting Tool.

---
1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
   - Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the Enable Retransmission Exponential Backoff flag, as required.

### 14.7.5.2 Configuring the Retransmission Exponential Backoff on the Web Service Client

**Note:** For more information about configuring web service clients, see Section 8.5, “Configuring Web Service Clients.”

Table 14–12 defines the `weblogic.wsee.reliability2.api.WsrmClientInitFeature` methods for configuring whether the message retransmission interval will be adjusted using the retransmission exponential backoff algorithm.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Boolean isRetransmissionExponentialBackoff()</code></td>
<td>Indicates whether retransmission exponential backoff is enabled.</td>
</tr>
<tr>
<td><code>void setBaseRetransmissionExponentialBackoff(boolean value)</code></td>
<td>Specifies whether base retransmission exponential backoff is enabled. Valid values are true or false.</td>
</tr>
</tbody>
</table>

In the following example, the retransmission exponential backoff is enabled.

```java
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
    ...
    @WebServiceRef(name="ReliableEchoService")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;
    WsrmClientInitFeature initFeature = new WsrmClientInitFeature(true);
    initFeature.setBaseRetransmissionInterval("P0DT3H");
    initFeature.setBaseRetransmissionExponentialBackoff(true);
    port = service.getMyReliableServicePort(initFeature);
    ...
}
```

The retransmission exponential backoff configuration appears in the `weblogic.xml` file as follows:

```xml
<service-reference-description>
    ...
    <port-info>
        <stub-property>
            <name>weblogic.wsee.wsrm.RetransmissionExponentialBackoff</name>
            <value>true</value>
        </stub-property>
    </port-info>
</service-reference-description>
```
14.7.6 Configuring the Sequence Expiration

The sequence expiration specifies the expiration time for a sequence regardless of activity.

The value specified must be a positive value and conform to the XML schema duration lexical format, \( P^nY^nM^nD^nT^nH^nM^nS \), where \( nY \) specifies the number of years, \( nM \) specifies the number of months, \( nD \) specifies the number of days, \( T \) is the date/time separator, \( nH \) specifies the number of hours, \( nM \) specifies the number of minutes, and \( nS \) specifies the number of seconds. This value defaults to \( P1D \) (1 day).

The following sections describe how to configure the sequence expiration:

- Section 14.7.6.1, "Configuring the Sequence Expiration on WebLogic Server or Web Service Endpoint"
- Section 14.7.6.2, "Configuring the Sequence Expiration on the Web Service Client"

14.7.6.1 Configuring the Sequence Expiration on WebLogic Server or Web Service Endpoint

To configure the sequence expiration on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
   - Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the **Sequence Expiration** value, as required.

14.7.6.2 Configuring the Sequence Expiration on the Web Service Client

**Note:** For more information about configuring web service clients, see Section 8.5, "Configuring Web Service Clients."

Table 14–13 defines that `weblogic.wsee.reliability2.api.WsrmClientInitFeature` methods for expiration time for a sequence regardless of activity.
Configuring Reliable Messaging

In the following example, the sequence expiration is set to 36 hours.

```java
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
...
    @WebServiceRef(name="ReliableEchoService")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;
    WsrmClientInitFeature initFeature = new WsrmClientInitFeature(true);
    initFeature.setSequenceExpiration("P0DT36H");
    port = service.getMyReliableServicePort(initFeature);
    ...
}
```

The sequence expiration configuration appears in the `weblogic.xml` file as follows:

```xml
<service-reference-description>
    ...
    <port-info>
        <stub-property>
            <name>weblogic.wsee.wsrmp.SequenceExpiration</name>
            <value>PT10M</value>
        </stub-property>
    ...
</port-info>
</service-reference-description>
```

### 14.7.7 Configuring Inactivity Timeout

If, during the inactivity timeout interval, an endpoint (the RM source or destination) has not received messages application or protocol messages, the endpoint may consider the RM sequence to have been terminated due to inactivity.

The value specified must be a positive value and conform to the XML schema duration lexical format, \( P^nY^nM^nD^nT^nH^nM^nS^n \), where \( nY \) specifies the number of years, \( nM \) specifies the number of months, \( nD \) specifies the number of days, \( T \) is the date/time separator, \( nH \) specifies the number of hours, \( nM \) specifies the number of minutes, and \( nS \) specifies the number of seconds. This value defaults to \( P0DT600S \) (600 seconds).

The following sections describe how to configure the inactivity timeout:

- **Section 14.7.7.1, "Configuring the Inactivity Timeout on WebLogic Server or Web Service Endpoint"
- **Section 14.7.7.2, "Configuring the Inactivity Timeout on the Web Service Client"
14.7.7.1 Configuring the Inactivity Timeout on WebLogic Server or Web Service Endpoint

To configure the inactivity timeout on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
   - Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the Inactivity Timeout value, as required.

14.7.7.2 Configuring the Inactivity Timeout on the Web Service Client

Table 14–14 defines that weblogic.wsee.reliability2.api.WsrmClientInitFeature methods for configuring the inactivity timeout.

In the following example, the inactivity timeout interval is set to 1 hour.

```java
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
... 
    @WebServiceRef(name="ReliableEchoService")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;
    WsrmClientInitFeature initFeature = new WsrmClientInitFeature(true);
    initFeature.setInactivityTimeout("P0DT1H");
    port = service.getMyReliableServicePort(initFeature);
... 
```

The inactivity timeout configuration appears in the `weblogic.xml` file as follows:

**Table 14–14 Methods for Configuring Inactivity Timeout**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>String getInactivityTimeout()</td>
<td>Returns the inactivity timeout currently configured.</td>
</tr>
<tr>
<td>void setInactivityTimeout(String timeout)</td>
<td>Sets the inactivity timeout.</td>
</tr>
</tbody>
</table>

Note: For more information about configuring web service clients, see Section 8.5, "Configuring Web Service Clients."

Note: Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see "Configuring Existing Domains" in Understanding the WebLogic Scripting Tool.
14.7.8 Configuring a Non-buffered Destination for a Web Service

You can control whether you want to disable message buffering on a particular destination server to control whether buffering is used when receiving messages. You can configure non-buffering on the destination server at the WebLogic Server or web service endpoint level only, not at the web service client level (buffering is enabled by default on a web service client).

Note: If you configure a non-buffered destination, any web service client that uses `@WebServiceRef` to define a reference to the configuration will receive responses without buffering them.

The non-buffered destination configuration appears in the weblogic.xml file as follows:

```xml
<service-reference-description>
  ...
  <port-info>
    <stub-property>
      <name>weblogic.wsee.wsrm.InactivityTimeout</name>
      <value>PT5M</value>
    </stub-property>
    ...
  </port-info>
</service-reference-description>
```

For more information about `@WebServiceRef`, see Section 8.6, "Defining a Web Service Reference Using the `@WebServiceRef` Annotation."

To configure the destination server to disable message buffering, on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

Note: Alternatively, you can use WLST to configure reliable messaging. For information about using WLST to extend the domain, see "Configuring Existing Domains" in Understanding the WebLogic Scripting Tool.

1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the **Non-buffered Destination** value, to configure the destination server, respectively, as required.

**Note:** On the source server, message buffering should always be enabled. That is, the **Non-buffered Source** value should always be disabled.

### 14.7.9 Configuring the Acknowledgement Interval

The acknowledgement interval specifies the maximum interval during which the destination endpoint must transmit a standalone acknowledgement. You can configure the acknowledgement interval at the WebLogic Server or web service endpoint level only, not at the web service client level.

**Note:** A web service client that uses @WebServiceRef to define a reference to the web service uses the acknowledgement interval value to control the amount of time that the client's response handling will wait until acknowledging responses that it receives. In other words, the client acts like an RM destination when receiving response messages.

The non-buffered destination configuration appears in the `weblogic.xml` file as follows:

```xml
<service-reference-description>
  ...
  <port-info>
    <stub-property>
      <name>weblogic.wsee.wsrm.AcknowledgementInterval</name>
      <value>PT5S</value>
    </stub-property>
    ...
  </port-info>
  ...
</service-reference-description>
```

For more information about @WebServiceRef, see Section 8.6, "Defining a Web Service Reference Using the @WebServiceRef Annotation."

A destination endpoint can send an acknowledgement on the return message immediately after it has received a message from a source endpoint, or it can send one separately as a standalone acknowledgement. If a return message is not available to send an acknowledgement, a destination endpoint may wait for up to the acknowledgement interval before sending a standalone acknowledgement. If there are no unacknowledged messages, the destination endpoint may choose not to send an acknowledgement.

The value specified must be a positive value and conform to the XML schema duration lexical format, \( PnYnMnDTnHnMnSn. \) **Table 14–15** describes the duration format fields. This value defaults to `PT0.2S` (0.2 seconds).
To configure the acknowledgement interval, on WebLogic Server or the web service endpoint level using the WebLogic Server Administration Console, perform the following steps:

1. Invoke the WebLogic Server Administration Console and access the web service reliable messaging pages at the server-level or web service endpoint level, as described in the following sections, respectively:
   - Section 14.7.1, "Configuring Reliable Messaging on WebLogic Server"
   - Section 14.7.2, "Configuring Reliable Messaging on the Web Service Endpoint"

2. Set the **Acknowledgement Interval** value, as required.

### 14.8 Implementing the Reliability Error Listener

To receive notifications related to reliability delivery failures in the event that a request cannot be delivered, you can implement the following `weblogic.wsee.reliability2.api.ReliabilityErrorListener` interface:

```java
public interface ReliabilityErrorListener {
    public void onReliabilityError(ReliabilityErrorContext context);
}
```

Table 14–16 defines that `weblogic.wsee.reliability2.api.WsrmClientInitFeature` methods for configuring the reliability error listener.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReliabilityErrorListener getReliabilityListener()</td>
<td>Gets the reliability listener currently configured.</td>
</tr>
<tr>
<td>void setErrorListener(ReliabilityErrorListener errorListener)</td>
<td>Sets the reliability error listener.</td>
</tr>
</tbody>
</table>
The following provides an example of how to implement and use a reliability error listener in your web service client. This example is excerpted from Example 13–1, "Reliable Web Service Client Best Practices Example."

```java
import weblogic.wsee.reliability2.api.ReliabilityErrorListener;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
    ...
    WsrmClientInitFeature rmFeature = new WsrmClientInitFeature();
    features.add(rmFeature);

    ReliabilityErrorListener listener = new ReliabilityErrorListener() {
        public void onReliabilityError(ReliabilityErrorContext context) {
            // At a *minimum* do this
            System.out.println("RM sequence failure: " +
                context.getFaultSummaryMessage());
            _lastResponse = context.getFaultSummaryMessage();

            // And optionally do this...

            // The context parameter tells you whether a request or the entire
            // sequence has failed. If a sequence fails, you'll get a notification
            // for each undelivered request (if any) on the sequence.
            if (context.isRequestSpecific()) {
                // We have a single request failure (possibly as part of a larger
                // sequence failure).
                // We can get the original request back like this:
                String operationName = context.getOperationName();
                System.out.println("Failed to deliver request for operation '" +
                    operationName + "'. Fault summary: " +
                    context.getFaultSummaryMessage());
                if ("DoSomething".equals(operationName)) {
                    try {
                        String request = context.getRequest(JAXBContext.newInstance(),
                            String.class);
                        System.out.println("Failed to deliver request for operation '" +
                            operationName + "' with content: " +
                            request);
                        Map<String, Serializable> requestProps =
                            context.getUserRequestContextProperties();
                        if (requestProps != null) {
                            // Fetch back any property you sent in
                            // JAXWSProperties.PERSISTENT_CONTEXT when you sent the
                            // request.
                            String myProperty = (String)requestProps.get(MY_PROPERTY);
                            System.out.println(myProperty + " failed!");
                        }
                    } catch (Exception e) {
                        e.printStackTrace();
                    }
                } else {
                    // The entire sequence has encountered an error.
                    System.out.println("Entire sequence failed: " +
                        context.getFaultSummaryMessage());
                }
            }
        }
    }
}```
Managing the Life Cycle of a Reliable Message Sequence

WebLogic Server provides a client API, weblogic.wsee.reliability2.api.WsrmClient, for use with the web service reliable messaging. Use this API to perform common life cycle tasks such as set configuration options, get the reliable sequence id, and terminate a reliable sequence.

An instance of the WsrmClient API can be accessed from the reliable web service port using the weblogic.wsee.reliability2.api.WsrmClientFactory method, as follows:

```java
package wsrm_jaxws.example;
import java.xml.ws.WebService;
import java.xml.ws.WebServiceRef;
import wsrm_jaxws.example.client_service.*;
import wsrm_jaxws.example.client_service.EchoResponse;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;
...
@WebService
public class ClientServiceImpl {
    ...
    @WebServiceRef(name="ReliableEchoService")
    private ReliableEchoService service;
    private ReliableEchoPortType port = null;
    port = service.getReliableEchoPort();
    WsrmClient wsrmClient = WsrmClientFactory.getWsrmClientFromPort(port);
    ...
}
```

The following sections describe how to manage the life cycle of a reliable message sequence using WsrmClient.

- Section 14.9.1, "Managing the Reliable Sequence"
- Section 14.9.2, "Managing the Client ID"
- Section 14.9.3, "Managing the Acknowledged Requests"
- Section 14.9.4, "Accessing Information About a Message"
- Section 14.9.5, "Identifying the Final Message in a Reliable Sequence"
- Section 14.9.6, "Closing the Reliable Sequence"
- Section 14.9.7, "Terminating the Reliable Sequence"
- Section 14.9.8, "Resetting a Client to Start a New Message Sequence"

For complete details on the web service reliable messaging client API, see weblogic.wsee.reliability2.api.WsrmClient in Java API Reference for Oracle WebLogic Server.
14.9.1 Managing the Reliable Sequence

To manage the reliable sequence, you can perform one or more of the following tasks.

■ Get and set the reliable sequence ID, as described in Section 14.9.1.1, "Getting and Setting the Reliable Sequence ID".

■ Access the state of the reliable sequence, for example, to determine if it is active or terminated, as described in Section 14.9.1.2, "Accessing the State of the Reliable Sequence".

14.9.1.1 Getting and Setting the Reliable Sequence ID

The sequence ID is used to identify a specific reliable sequence. You can get and set the sequence ID using the `weblogic.wsee.reliability2.api.WsrmClient.getSequenceID()` and `weblogic.wsee.reliability2.api.WsrmClient.setSequenceID()` methods, respectively. If no messages have been sent when you issue the `getSequenceID()` method, the value returned is null.

For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmClient;
...
_service = new BackendReliableServiceService();
...
_features.add(... some features ...);
_features = features.toArray(new WebServiceFeature[features.size()]);
...
 BackendReliableService anotherPort =
_service.getBackendReliableServicePort(_features);
...
WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
// Will be null
String sequenceId = rmClient.getSequenceId();
// Send first message
anotherPort.doSomething("Bake a cake");
// Will be non-null
sequenceId = rmClient.getSequenceId();
```

During recovery from a server failure, you can set the reliable sequence on a newly created web service port or dispatch instance after a client or server restart. Setting the sequence ID for a client instance is an advanced feature. Advanced clients may use `setSequenceId` to connect a client instance to a known RM sequence.

14.9.1.2 Accessing the State of the Reliable Sequence

To access the state of a sequence, use `weblogic.wsee.reliability2.api.WsrmClient.getSequenceState()`. This method returns an `java.lang.Enum` constant of the type `weblogic.wsee.reliability2.api.SequenceState`.

The following table defines valid values that may be returned for sequence state.
For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmClient;
import weblogic.wsee.reliability2.api.SequenceState;
...
    _service = new BackendReliableServiceService();
...
    features.add...(some features ...);
    _features = features.toArray(new WebServiceFeature[features.size()]);
...
    BackendReliableService anotherPort =
        _service.getBackendReliableServicePort(_features);
...
    WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
    SequenceState rmState = rmClient.getSequenceState();
    if (rmState == SequenceState.TERMINATED) {
```

### Table 14–17  Sequence State Values

<table>
<thead>
<tr>
<th>Sequence State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td>Reliable sequence is closed.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Closing a sequence should be considered a <em>last resort</em>, and only to prepare to close down a reliable messaging sequence for which you do not expect to receive the full range of requests. For more information, see Section 14.9.6, &quot;Closing the Reliable Sequence&quot;</td>
</tr>
<tr>
<td>CLOSING</td>
<td>Reliable sequence is in the process of being closed.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Closing a sequence should be considered a <em>last resort</em>, and only to prepare to close down a reliable messaging sequence for which you do not expect to receive the full range of requests. For more information, see Section 14.9.6, &quot;Closing the Reliable Sequence&quot;</td>
</tr>
<tr>
<td>CREATED</td>
<td>Reliable sequence has been created and the initial handshaking is complete.</td>
</tr>
<tr>
<td>CREATING</td>
<td>Reliable sequence is being created; the initial handshaking is in progress.</td>
</tr>
<tr>
<td>LAST_MESSAGE</td>
<td>Deprecated. WS-ReliableMessaging 1.0 only. The last message in the sequence has been received.</td>
</tr>
<tr>
<td>LAST_MESSAGE_PENDING</td>
<td>Deprecated. WS-ReliableMessaging 1.0 only. The last message in the sequence is pending.</td>
</tr>
<tr>
<td>NEW</td>
<td>Reliable sequence is in its initial state. Initial handshaking has not started.</td>
</tr>
<tr>
<td>TERMINATED</td>
<td>Reliable sequence is terminated.</td>
</tr>
<tr>
<td></td>
<td>Under normal processing, after all messages up to and including the final message are acknowledged, the reliable message sequence is terminated. Though not recommended, you can force the termination of a reliable sequence, as described in Section 14.9.7, &quot;Terminating the Reliable Sequence&quot;.</td>
</tr>
<tr>
<td>TERMINATING</td>
<td>Reliable sequence is in the process of being terminated.</td>
</tr>
<tr>
<td></td>
<td>Under normal processing, after all messages up to and including the final message are acknowledged, the reliable message sequence is terminated. Though not recommended, you can force the termination of a reliable sequence, as described in Section 14.9.7, &quot;Terminating the Reliable Sequence&quot;.</td>
</tr>
</tbody>
</table>
14.9.2 Managing the Client ID

The client ID identifies the web service client. Each client has its own unique ID. The client ID can be used to access saved requests that may exist for a reliable sequence after a client or server restart.

The client ID is configured automatically by WebLogic Server. You can set the client ID to a custom value when creating the port using the `weblogic.wsee.jaxws.persistence.ClientIdentityFeature`. For more information, see Section 8.7, "Managing Client Identity."

Reliable messaging uses the client ID to find any requests that were sent prior to a VM restart that were not sent before the VM exited. When you establish the first client instance using the prior client ID, reliable messaging uses the resources associated with that port to begin sending requests on behalf of the restored client ID.

You can get the client ID using the `weblogic.wsee.reliability2.api.WsrmClient.getID()` method.

For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmClient;
...
_service = new BackendReliableServiceService();
...
_features.add(... some features ...);
_features = features.toArray(new WebServiceFeature[features.size()]);
...
BackendReliableService anotherPort =
_service.getBackendReliableServicePort(_features);
...
WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
String clientId = rmClient.getId();
...
```

14.9.3 Managing the Acknowledged Requests

Use the `weblogic.wsee.reliability2.api.WsrmClient.ackRanges()` method to display the requests that have been acknowledged during the life cycle of a reliable message sequence. The `ackRanges()` method returns a set of `weblogic.wsee.reliability.MessageRange` objects.

After reviewing the range of requests that have been acknowledged, the client may choose to:

- Send an acknowledgement request to the RM destination using the `weblogic.wsee.reliability2.api.WsrmClient.requestAcknowledgement()` method.
- Close the sequence (see Section 14.9.6, "Closing the Reliable Sequence") and perform error handling to account for unacknowledged messages after a specific amount of time.
**Note:** Clients may call `getAckRanges()` repeatedly, to keep track of the reliable message sequence over time. However, you should take into account that there is a certain level of additional overhead associated each call.

### 14.9.4 Accessing Information About a Message

Use the `weblogic.wsee.reliability2.api.WsrmClient.getMessageInfo()` method to get information about a reliable message sent from the client based on the message number. This method accepts a long value representing the sequential message number of a request message sent from the client instance, and returns information about the message of type `weblogic.wsee.reliability2.sequence.SourceMessageInfo`. You can use the `WsrmClient.getMostRecentMessageNumber()` method to determine the maximum value of the message number value to pass to `getMessageInfo()`.

The returned `SourceMessageInfo` object should be treated as immutable, and only the get methods should be used.

The following table lists the `SourceMessageInfo` methods that you can use to access specific details about the source message.

**Table 14–18 Methods for SourceMessageInfo()**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>getMessageID()</code></td>
<td>Gets the message ID as a String value.</td>
</tr>
<tr>
<td><code>getMessageNum()</code></td>
<td>Gets the number of the message as a long value.</td>
</tr>
<tr>
<td><code>getResponseMessageInfo()</code></td>
<td>Returns a <code>weblogic.wsee.reliability2.sequence.DestinationMessageInfo</code> object representing the response that has been correlated to the request represented by the current <code>SourceMessageInfo()</code> object. Returns NULL if no response has been received for this request or if none is expected (for example, request was one way).</td>
</tr>
<tr>
<td><code>isAck()</code></td>
<td>Indicates whether the message has been acknowledged.</td>
</tr>
</tbody>
</table>

The following table lists the `DestinationMessageInfo` methods that you can use to access specific details about the destination message.

**Table 14–19 Methods for DestinationMessageInfo()**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>getMessageID()</code></td>
<td>Gets the message ID as a String value.</td>
</tr>
<tr>
<td><code>getMessageNum()</code></td>
<td>Gets the number of the message as a long value.</td>
</tr>
</tbody>
</table>

The `getMessageInfo()` method can be used in conjunction with `weblogic.wsee.reliability2.api.WsrmClient.getMostRecentMessageNumber()` to obtain information about the most recently sent reliable message. This method returns a monotonically increasing long value, starting from 1. This method will return -1 in the following circumstances:

- If the reliable sequence ID has not been established (`getSequenceID()` returns null).
- The first reliable message has not been sent yet.
- The reliable sequence has been terminated.
### 14.9.5 Identifying the Final Message in a Reliable Sequence

Because WebLogic Server retains resources associated with the reliable sequence, it is recommended that you take steps to release these resources in a timely fashion. Under normal circumstances, a reliable sequence should be retained until all messages have been sent and acknowledged by the RM destination. To facilitate the timely and proper termination of a sequence, it is recommended that you identify the final message in a reliable message sequence. Doing so indicates you are done sending messages to the RM destination and that WebLogic Server can begin looking for the final acknowledgement before automatically terminating the reliable sequence. Indicate the final message using the `weblogic.wsee.reliability2.api.WsrmClient.setFinalMessage()` method.

When you identify a final message, after all messages up to and including the final message are acknowledged, the reliable message sequence is terminated, and all resources are released. Otherwise, the sequence is terminated automatically after the configured sequence expiration period is reached.

For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmClient;
...
_service = new BackendReliableServiceService();
...
_features.add(... some features ...);
_features = features.toArray(new WebServiceFeature[features.size()]);
...
BackendReliableService anotherPort =
_service.getBackendReliableServicePort(_features);
...
WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
afterPort.doSomething("One potato");
afterPort.doSomething("Two potato");
afterPort.doSomething("Three potato");
// Indicate this next invoke marks the 'final' message for the sequence
rmClient.setFinalMessage();
afterPort.doSomething("Four");
...
```

### 14.9.6 Closing the Reliable Sequence

Use the `weblogic.wsee.reliability2.api.WsrmClient.closeMessage()` to close a reliable messaging sequence.

**Note:** This method is valid for WS-ReliableMessaging 1.1 only; it is not supported for WS-ReliableMessaging 1.0.

When a reliable messaging sequence is closed, no new messages will be accepted by the RM destination or sent by the RM source. A closed sequence is still tracked by the RM destination and continues to service acknowledgment requests against it. It allows the RM source to get a full and final accounting of the reliable messaging sequence before terminating it.

**Note:** Closing a sequence should be considered a last resort, and only to prepare to close down a reliable messaging sequence for which you do not expect to receive the
full range of requests. For example, after reviewing the range of requests that have been acknowledged (see Section 14.9.3, "Managing the Acknowledged Requests"), the client may decide it necessary to close the sequence and perform error handling to account for unacknowledged messages after a specific amount of time.

Once a reliable messaging sequence is closed, it is up to the client to terminate the sequence; it will no longer be terminated automatically by the server after a configured timeout has been reached. See Section 14.9.7, “Terminating the Reliable Sequence”.

For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmClient;
...
_service = new BackendReliableServiceService();
...
_features.add(... some features ...);
_features = features.toArray(new WebServiceFeature[features.size()]);
...
 BackendReliableService anotherPort =
_service.getBackendReliableServicePort(_features);
...
WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
anotherPort.doSomething("One potato");
anotherPort.doSomething("Two potato");
// ... Wait some amount of time, and check for acks
// ... using WsrmClient.getAckRanges() ...
// ... If we don't find all of our acks ...
rmClient.closeSequence();
// ... Do some error recovery like telling our
// ... client we couldn't deliver all requests ...
rmClient.terminateSequence();
...
```

### 14.9.7 Terminating the Reliable Sequence

Although not recommended, you can terminate the reliable message sequence regardless of whether all messages have been acknowledged using the `WsrmClient.terminateSequence()` method.

**Note:** It is recommended that, instead, you use the `setFinalMessage()` method to identify the final message in a reliable sequence. When you identify a final message, after all messages up to and including the final message are acknowledged, the reliable message sequence is terminated, and all resources are released. For more information, see Section 14.9.5, "Identifying the Final Message in a Reliable Sequence".

Terminating a sequence causes the RM source and RM destination to remove all state associated with that sequence. The client can no longer perform any action on a terminated sequence. When a sequence is terminated, any pending requests being delivered through server-side retry (SAF agents) for the sequence are rejected and sent as a notification on the `ReliabilityErrorListener`.

For example:

```java
import weblogic.wsee.reliability2.api.WsrmClientFactory;
```
import weblogic.wsee.reliability2.api.WsrmClient;

...  _service = new BackendReliableServiceService();
...
  features.add(... some features ...);
  _features = features.toArray(new WebServiceFeature[features.size()]);
...
  BackendReliableService anotherPort =
      _service.getBackendReliableServicePort(_features);
...
  WsrmClient rmClient = WsrmClientFactory.getWsrmClientFromPort(anotherPort);
...
  anotherPort.doSomething("One potato");
  anotherPort.doSomething("Two potato");
  // ... Wait some amount of time, and check for acks
  // ... using WsrmClient.getAckRanges() ...
  // ... If we don't find all of our acks ...
  rmClient.closeSequence();
  // ... Do some error recovery like telling our
  // ... client we couldn't deliver all requests ...
  rmClient.terminateSequence();
...

14.9.8 Resetting a Client to Start a New Message Sequence

Use the weblogic.wsee.reliability2.api.WsrmClient.reset() method to clear all
RequestContext properties related to reliable messaging that do not need to be
retained once the reliable sequence is closed. Typically, this method is called when you
want to initiate another sequence of reliable messages from the same client.

For an example of using reset(), see Example B–1, "Example Client Wrapper Class for
Batching Reliable Messages".

14.10 Monitoring Web Services Reliable Messaging

You can monitor reliable messaging sequences for a web service or client using the
WebLogic Server Administration Console. For each reliable messaging sequence,
runtime monitoring information is displayed, such as the sequence state, the source
and destination servers, and so on. You can customize the information that is shown in
the table by clicking Customize this table.

In particular, you can use the monitoring pages to determine:

- Whether or not you are cleaning up sequences in a timely fashion. If you view a
  large number of sequences in the monitoring tab, you may wish to review your
  client code to determine why.

- Whether an individual sequence has unacknowledged requests, or has not
  received expected responses.

To monitor reliable messaging sequences for a web service, click on the Deployments
node in the left pane and, in the Deployments table that appears in the right pane,
locate the Enterprise application in which the web service is packaged. Expand the
application by clicking the + node; the web services in the application are listed under
the Web Services category. Click on the name of the web service and select
Monitoring> Ports> Reliable Messaging.

To monitor reliable messaging sequences for a web service client, click on the
Deployments node in the left pane and, in the Deployments table that appears in the
right pane, locate the Enterprise application in which the web service client is packaged. Expand the application by clicking the + node and click on the application module within which the web service client is located. Click the Monitoring tab, then click the Web Service Clients tab. Then click Monitoring> Servers> Reliable Messaging.

### 14.11 Grouping Messages into Business Units of Work (Batching)

Often, the messages flowing between a web service client and service are part of a single business transaction or unit of work. An example might be a travel agency reservation process that requires messages between the agency, airline, hotel, and rental car company. All of the messages flowing between any two endpoints could be considered a business unit of work.

Reliable messaging is tailored to handling messages related to a unit of work by grouping them into an RM sequence. The entire unit of work (or sequence) is treated as a whole, and error recovery, and so on can be applied to the entire sequence (see the IncompleteSequenceBehavior element description in the WS-ReliableMessaging 1.2 specification (February 2009) at http://docs.oasis-open.org/ws-rx/wsrm/200702). For example, an RM sequence can be configured to discard requests that occur after a gap in the sequence, or to discard the entire sequence of requests if any request is missing from the sequence.

You can indicate that a message is part of a business unit of work by creating a new client instance before sending the first message in the unit, and by disposing of the client instance after the last message in the unit. Alternatively, you can use the WsrmClient API (obtained by passing a client instance to the WsrmClientFactory.getWsrmClientFromPort() method) to identify the final request in a sequence is about to be sent. This is done by calling WsrmClient.setFinalMessage() just before performing the invoke on the client instance, as described in Section 14.9.5, "Identifying the Final Message in a Reliable Sequence."

There is some significant overhead associated with the RM protocol. In particular, creating and terminating a sequence involves a round-trip message exchange with the service (RM destination). This means that four messages must go across the wire to establish and then terminate an RM sequence. For this reason, it is to your advantage to send the requests within a single business unit of work on a single RM sequence. This allows you to amortize the cost of the RM protocol overhead over a number of business messages.

In some cases, the client instance being used to talk to the reliable service runs in an environment where there is no intrinsic notion of the business unit of work to which the messages belong. An example of this is an intermediary such as a message broker. In this case, the broker is often aware only of the message itself, and not the context in which the message is being sent. The broker may not do anything to demarcate the start and end of a business unit of work (or sequence); as a result, when using reliable messaging to send requests, the broker will incur the RM sequence creation and termination protocol overhead for every message it sends. This can result in a serious negative performance impact.

In cases where no intrinsic business unit of work is known for a message, you can choose to arbitrarily group (or batch) messages into an artificially created unit of work (called a batch). Batched messages can overcome the performance impact described above and can be used to tune and optimize network usage and throughput between a reliable messaging client and service. Testing has shown that batching otherwise unrelated requests into even small batches (say 10 requests) can as much as
triple the throughput between the client and service when using reliable messaging (when sending small messages).

---

**Note:** Oracle does not recommend batching requests that already have an association with a business unit of work. This is because error recovery can become complicated when RM sequence boundaries and unit of work boundaries do not match. For example, when you add a `ReliabilityErrorListener` to your client instance (via `WsrmClientInitFeature`), as described in Section 14.8, "Implementing the Reliability Error Listener," this listener can be used to perform error recovery for single requests in a sequence or whole-sequence failures. When batching requests, this error recovery logic would need to store some information about each request in order to properly handle the failure of a request. A client that does not employ batching will likely have more context about the request given the business unit of work it belongs to.

The following code excerpt shows an example class called `BatchingRmClientWrapper` that can be used to make batching of RM requests simple and effective. This class batches requests into groups of a specified number of requests. It allows you to create a dynamic proxy that takes the place of your regular client instance. When you make invocations on the client instance, the batching wrapper seamlessly groups the outgoing requests into batches, and assigns each batch its own RM sequence. The batching wrapper also takes a duration specification that indicates the maximum lifetime of any given batch. This allows incomplete batches to be completed in a timely fashion even if there are not enough outgoing requests to completely fill a batch. If the batch has existed for the maximum lifetime specified, it will be closed as if the last message in the batch had been sent.

An example of the client wrapper class that can be used for batching reliable messaging is provided in Appendix B, "Example Client Wrapper Class for Batching Reliable Messages." You can use this class as-is in your own application code, if desired.

---

**Example 14–2 Example of Grouping Messages into Units of Work (Batching)**

```java
import java.io.IOException;
import java.util.*;
import java.util.*;
import javax.servlet.*;
import javax.xml.ws.*;
import weblogic.jws.jaxws.client.ClientIdentityFeature;
import weblogic.jws.jaxws.client.async.AsyncClientHandlerFeature;
import weblogic.jws.jaxws.client.async.AsyncClientTransportFeature;
import weblogic.wsee.reliability2.api.ReliabilityErrorContext;
import weblogic.wsee.reliability2.api.ReliabilityErrorListener;
import weblogic.wsee.reliability2.api.WsrmClientInitFeature;

/**
 * Example client for invoking a reliable web service and 'batching' requests
 * artificially into a sequence. A wrapper class called
 * BatchingRmClientWrapper is called to begin and end RM sequences for each batch of
 * requests. This avoids per-message RM sequence handshaking
 * and termination overhead (delivering better performance).
 */
```

---

14-46  Developing JAX-WS Web Services for Oracle WebLogic Server
public class BestPracticeAsyncRmBatchingClient extends GenericServlet {

    private BackendReliableServiceService _service;
    private BackendReliableService _singletonPort;
    private BackendReliableService _batchingPort;

    private static int _requestCount;
    private static String _lastResponse;

    @Override
    public void init() throws ServletException {
        _requestCount = 0;
        _lastResponse = null;

        // Only create the web service object once as it is expensive to create repeatedly.
        if (_service == null) {
            _service = new BackendReliableServiceService();
        }

        // Best Practice: Use a stored list of features, per client ID, to create client instances.
        // Define all features for the web service port, per client ID, so that they are
        // consistent each time the port is called. For example:
        // _service.getBackendServicePort(_features);

        List<WebServiceFeature> features = new ArrayList<WebServiceFeature>();

        // Best Practice: Explicitly define the client ID.
        ClientIdentityFeature clientIdFeature =
            new ClientIdentityFeature("MyBackendServiceAsyncRmBatchingClient");
        features.add(clientIdFeature);

        // Best Practice: Always implement a reliability error listener.
        // Include this feature in your reusable feature list. This enables you to determine
        // a reason for failure, for example, RM cannot deliver a request or the RM sequence fails in
        // some way (for example, client credentials refused at service).
        WsrmClientInitFeature rmFeature = new WsrmClientInitFeature();
        features.add(rmFeature);
        rmFeature.setErrorListener(new ReliabilityErrorListener() {
            public void onReliabilityError(ReliabilityErrorContext context) {
                // At a *minimum* do this
                System.out.println("RM sequence failure: " +
                    context.getFaultSummaryMessage());
                _lastResponse = context.getFaultSummaryMessage();
            }
        });

        // Asynchronous endpoint
        AsyncClientTransportFeature asyncFeature =
            new AsyncClientTransportFeature(getServletContext());
        features.add(asyncFeature);

        // Best Practice: Define a port-based asynchronous callback handler,
        // AsyncClientHandlerFeature, for asynchronous and dispatch callback handling.
        BackendReliableServiceAsyncHandler handler =
            new BackendReliableServiceAsyncHandler() {
                public void onDoSomethingResponse(Response<DoSomethingResponse> res) {
                    // ... Handle Response ...
                }
            };
try {
    DoSomethingResponse response = res.get();
    _lastResponse = response.getReturn();
    System.out.println("Got reliable/async/batched response: " + _lastResponse);
} catch (Exception e) {
    _lastResponse = e.toString();
    e.printStackTrace();
}

AsyncClientHandlerFeature handlerFeature =
    new AsyncClientHandlerFeature(handler);
features.add(handlerFeature);

// Set the features used when creating clients with
// this client ID "MyBackendServiceAsyncRmBatchingClient"
WebServiceFeature[] featuresArray =
    features.toArray(new WebServiceFeature[features.size()]);

    // Best Practice: Define a singleton port instance and initialize it when
    // the client container initializes (upon deployment).
    // The singleton port will be available for the life of the servlet.
    // Creation of the singleton port triggers the asynchronous response endpoint to be published
    // and it will remain published until our container (Web application) is undeployed.
    // Note, we will get a call to destroy() before this.
    _singletonPort = _service.getBackendReliableServicePort(featuresArray);

    // Create a wrapper class to 'batch' messages onto RM sequences so
    // a client with no concept of which messages are related as a unit can still achieve
    // good performance from RM. The class will send a given number of requests on
    // the same sequence, and then terminate that sequence before starting
    // another to carry further requests. A batch has both a max size and
    // lifetime so no sequence is left open for too long.
    // The example batches 10 messages or executes for 20 seconds, whichever comes
    // first. Assuming there were 15 total requests to send, the class would start and complete
    // one full batch of 10 requests, then send the next batch of five requests.
    // Once the batch of five requests has been open for 20 seconds, it will be closed and the
    // associated sequence terminated (even though 10 requests were not sent to fill the batch).
    BackendReliableService batchingPort =
        _service.getBackendReliableServicePort(featuresArray);
    BatchingRmClientWrapper<BackendReliableService> batchingSeq
        = new BatchingRmClientWrapper<BackendReliableService>(batchingPort,
            BackendReliableService.class,
            10, "PT20S",
            System.out);

    _batchingPort = batchingSeq.createProxy();
}

@Override
public void service(ServletRequest req, ServletResponse res)
    throws ServletException, IOException {
    // TODO: ... Read the servlet request ...

    // For this simple example, echo the _lastResponse captured from
    // an asynchronous DoSomethingResponse response message.
    if (_lastResponse != null) {
        res.getWriter().write(_lastResponse);
System.out.println("Servlet returning _lastResponse value: " + _lastResponse);
_lastResponse = null; // Clear the response so we can get another
return;
}

// Synchronize on _batchingPort since it is a class-level variable and it might
// be in this method on multiple threads from the servlet engine.
synchronized(_batchingPort) {

    // Use the 'batching' port to send the requests instead of creating a
    // new request each time.
    BackendReliableService port = _batchingPort;

    // Set the endpoint address for BackendService.
    ((BindingProvider)port).getRequestContext().
        put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
            "http://localhost:7001/BestPracticeReliableService/BackendReliableService");

    // Make the invocation. Our asynchronous handler implementation (set
    // into the AsyncClientHandlerFeature above) receives the response.
    String request = "Protected and serve " + (++_requestCount);
    System.out.println("Invoking DoSomething reliably/async/batched with request: " +
        request);
    port.doSomethingAsync(request);
}

// Return a canned string indicating the response was not received
// synchronously. Client needs to invoke the servlet again to get
// the response.
res.getWriter().write("Waiting for response...");
}

@Override
public void destroy() {
    try {
        // Best Practice: Explicitly close client instances when processing is complete.
        // Close the singleton port created during initialization. Note, the asynchronous
        // response endpoint generated by creating _singletonPort *remains*
        // published until our container (Web application) is undeployed.
        ((java.io.Closeable)_singletonPort).close();
        // Best Practice: Explicitly close client instances when processing is complete.
        // Close the batching port created during initialization. Note, this will close
        // the underlying client instance used to create the batching port.
        ((java.io.Closeable)_batchingPort).close();

        // Upon return, the Web application is undeployed, and the asynchronous
        // response endpoint is stopped (unpublished). At this point,
        // the client ID used for _singletonPort will be unregistered and will no longer be
        // visible from the Administration Console and WLST.
    } catch (Exception e) {
        e.printStackTrace();
    }
}
14.12 Client Considerations When Redeploying a Reliable Web Service

WebLogic Server supports production redeployment, which means that you can deploy a new version of an updated reliable WebLogic web service alongside an older version of the same web service.

WebLogic Server automatically manages client connections so that only new client requests are directed to the new version. Clients already connected to the web service during the redeployment continue to use the older version of the service until they complete their work, at which point WebLogic Server automatically retires the older web service. If the client is connected to a reliable web service, its work is considered complete when the existing reliable message sequence is explicitly ended by the client or as a result of a timeout.

For additional information about production redeployment and web service clients, see Section 8.9, "Client Considerations When Redeploying a Web Service."

14.13 Interoperability with WebLogic Web Service Reliable Messaging

The WebLogic web services reliable messaging implementation will interoperate with the web service reliable messaging implementations provided by the following third-party vendor web services: IBM and Microsoft .NET. For best practices when interoperating with Microsoft .NET, see "Interoperability with Microsoft WCF/.NET" in Understanding WebLogic Web Services for Oracle WebLogic Server.

To enhance interoperability with Oracle SOA services that use web services reliable messaging, please consider the following interoperability guidelines:

- Do not use Make Connection for asynchronous transport, as described in Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)." Reliable SOA services do not support Make Connection.

- Do not use WS-SecureConversation to secure reliable web services. SOA services do not support the use of web services reliable messaging and WS-SecureConversation together.

- For reliable WebLogic web service clients that are accessing reliable SOA services:
  - Use synchronous (anonymous WS-Addressing ReplyTo EPR) request-reply or one-way MEP (Message exchange pattern).
  - Do not use asynchronous (non-anonymous WS-Addressing ReplyTo EPR) request-reply MEP.

- For reliable SOA clients that are accessing reliable WebLogic web services, use one of the following:
  - Synchronous (anonymous WS-Addressing ReplyTo EPR) request-reply or one-way MEP.
  - Asynchronous (non-anonymous WS-Addressing ReplyTo EPR) request-reply MEP.
Using Web Services Atomic Transactions

This chapter describes how to use web services atomic transactions for WebLogic web services using Java API for XML Web Services (JAX-WS) to enable interoperability with other external transaction processing systems.

This chapter includes the following sections:
- Section 15.1, "Overview of Web Services Atomic Transactions"
- Section 15.2, "Configuring the Domain Resources Required for Web Service Advanced Features"
- Section 15.3, "Enabling Web Services Atomic Transactions on Web Services"
- Section 15.4, "Enabling Web Services Atomic Transactions on Web Service Clients"
- Section 15.5, "Configuring Web Services Atomic Transactions Using the Administration Console"
- Section 15.6, "Using Web Services Atomic Transactions in a Clustered Environment"
- Section 15.7, "More Examples of Using Web Services Atomic Transactions"

15.1 Overview of Web Services Atomic Transactions

WebLogic web services enable interoperability with other external transaction processing systems, such as Websphere, Microsoft .NET, and so on, through the support of the following specifications:
- Web Services Atomic Transaction (WS-AtomicTransaction) Versions 1.0, 1.1, and 1.2:
  http://docs.oasis-open.org/ws-tx/wstx-wsat-1.2-spec-cs-01/wstx-wsat-1.2-spec-cs-01.html
- Web Services Coordination (WS-Coordination) Versions 1.0, 1.1, and 1.2:
  http://docs.oasis-open.org/ws-tx/wstx-wscoor-1.2-spec-cs-01/wstx-wscoor-1.2-spec-cs-01.html

These specifications define an extensible framework for coordinating distributed activities among a set of participants. The coordinator, shown in the following figure, is the central component, managing the transactional state (coordination context) and enabling web services and clients to register as participants.
The following table describes the components of web services atomic transactions, shown in the previous figure.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinator</td>
<td>Manages the transactional state (coordination context) and enables web services and clients to register as participants.</td>
</tr>
<tr>
<td>Activation Service</td>
<td>Enables the application to activate a transaction and create a coordination context for an activity. Once created, the coordination context is passed with the transaction flow.</td>
</tr>
<tr>
<td>Registration Service</td>
<td>Enables an application to register as a participant.</td>
</tr>
<tr>
<td>Application Protocol X, Y</td>
<td>Supported coordination protocols, such as WS-AtomicTransaction.</td>
</tr>
</tbody>
</table>

The following figure shows two instances of WebLogic Server interacting within the context of a web services atomic transaction. For simplicity, two WebLogic web service applications are shown.

Please note the following:

- Using the local JTA transaction manager, a transaction can be imported to or exported from the local JTA environment as a subordinate transaction, all within the context of a web service request.
- Creation and management of the coordination context is handled by the local JTA transaction manager.
All transaction integrity management and recovery processing is done by the local JTA transaction manager.

For more information about JTA, see Developing JTA Applications for Oracle WebLogic Server.

The following describes a sample end-to-end web services atomic transaction interaction, illustrated in Figure 15–2:

1. Application A begins a transaction on the current thread of control using the JTA transaction manager on Server A.
2. Application A calls a web service method in Application B on Server B.
3. Server A updates its transaction information and creates a SOAP header that contains the coordination context, and identifies the transaction and local coordinator.
4. Server B receives the request for Application B, detects that the header contains a transaction coordination context and determines whether it has already registered as a participant in this transaction. If it has, that transaction is resumed and if not, a new transaction is started.

   Application B executes within the context of the imported transaction. All transactional resources with which the application interacts are enlisted with this imported transaction.

5. Server B enlists itself as a participant in the WS-AtomicTransaction transaction by registering with the registration service indicated in the transaction coordination context.
6. Server A resumes the transaction.
7. Application A resumes processing and commits the transaction.

15.2 Configuring the Domain Resources Required for Web Service Advanced Features

When creating or extending a domain, if you expect that you will be using other web service advanced features in addition to web service atomic transactions (either now or in the future), you can apply the WebLogic Advanced Web Services for JAX-WS Extension template (wls_webbservice_jaxws.jar) to configure automatically the resources required to support the advanced web service features. Although use of this extension template is not required, it makes the configuration of the required resources much easier. Alternatively, you can configure the resources required for these advanced features using the Oracle WebLogic Server Administration Console or WLST. For more information, see Section 3.2, "Configuring Your Domain For Advanced Web Services Features."

Note: If you do not expect to use other web service advanced features with web service atomic transactions, application of this extension template is not required, minimizing start-up times and memory footprint.

15.3 Enabling Web Services Atomic Transactions on Web Services

To enable web services atomic transactions on a web service:
When starting from Java (bottom-up), add the `@weblogic.wsee.wstx.wsat.Transactional` annotation to the web service endpoint implementation class or method. For more information, see Section 15.3.1, "Using the @Transactional Annotation in Your JWS File".

When starting from WSDL (top-down), use `wsdlc` to generate a web service from an existing WSDL file. In this case, The WS-AtomicTransaction policy assertions that are advertised in the WSDL are carried forward and are included in the WSDL file for the new web service generated by `wsdlc`. See Section 15.3.2, "Enabling Web Services Atomic Transactions Starting From WSDL".

At deployment time, enable and configure web services atomic transactions at the web service endpoint or method level using the WebLogic Server Administration Console. For more information, see Section 15.5, "Configuring Web Services Atomic Transactions Using the Administration Console".

The following tables summarizes the configuration options that you can set when enabling web services atomic transactions.

### Table 15–2   Web Services Atomic Transactions Configuration Options

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>Version of the web services atomic transaction coordination context that is used for web services and clients. For clients, it specifies the version used for outbound messages only. The value specified must be consistent across the entire transaction. Valid values include WSAT10, WSAT11, WSAT12, and DEFAULT. The DEFAULT value for web services is all three versions (driven by the inbound request); the DEFAULT value for web service clients is WSAT10.</td>
</tr>
<tr>
<td>Flow type</td>
<td>Whether the web services atomic transaction coordination context is passed with the transaction flow. For valid values, see Table 15–3.</td>
</tr>
</tbody>
</table>

The following table summarizes the valid values for flow type and their meaning on the web service and client. The table also summarizes the valid value combinations when configuring web services atomic transactions for an EJB-style web service that uses the `@TransactionAttribute` annotation.
15.3.1 Using the @Transactional Annotation in Your JWS File

To enable web services atomic transactions, specify the @weblogic.wsee.wstx.wsat.Transactional annotation on the web service endpoint implementation class or method.

<table>
<thead>
<tr>
<th>Value</th>
<th>Web Service Client</th>
<th>Web Service</th>
<th>Valid EJB @TransactionAttribute Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEVER</td>
<td>JTA transaction: Do not export transaction coordination context.</td>
<td>Transaction flow exists: Do not import transaction coordination context. If the CoordinationContext header contains mustunderstand=&quot;true&quot;, a SOAP fault is thrown.</td>
<td>NEVER, NOT_SUPPORTED, REQUIRED, REQUIRES_NEW, SUPPORTS</td>
</tr>
<tr>
<td></td>
<td>No JTA transaction: Do not export transaction coordination context.</td>
<td>No transaction flow: Do not import transaction coordination context.</td>
<td></td>
</tr>
<tr>
<td>SUPPORTS (Default)</td>
<td>JTA transaction: Export transaction coordination context.</td>
<td>Transaction flow exists: Import transaction context.</td>
<td>REQUIRED, SUPPORTS</td>
</tr>
<tr>
<td></td>
<td>No JTA transaction: Do not export transaction coordination context.</td>
<td>No transaction flow: Do not import transaction coordination context.</td>
<td></td>
</tr>
<tr>
<td>MANDATORY</td>
<td>JTA transaction: Export transaction coordination context.</td>
<td>Transaction flow exists: Import transaction context.</td>
<td>MANDATORY, REQUIRED, SUPPORTS</td>
</tr>
<tr>
<td></td>
<td>No JTA transaction: An exception is thrown.</td>
<td>No transaction flow: Service-side exception is thrown.</td>
<td></td>
</tr>
</tbody>
</table>

**Table 15–3 Flow Types Values**

**Note:** This annotation is not to be mistaken with weblogic.jws.Transactional, which ensures that the annotated class or operation runs inside of a transaction, but not an atomic transaction.

Please note the following:

- If you specify the @Transactional annotation at the web service class level, the settings apply to all two-way methods defined by the service endpoint interface. You can override the flow type value at the method level; however, the version must be consistent across the entire transaction.
- You cannot explicitly specify the @Transactional annotation on a Web method that is also annotated with @Oneway.
- Web services atomic transactions cannot be used with the client-side asynchronous programming model.

The format for specifying the @Transactional annotation is as follows:

```java
@Transactional(
    version=Transactional.Version.[WSAT10|WSAT11|WSAT12|DEFAULT],
    value=Transactional.TransactionFlowType.[MANDATORY|SUPPORTS|NEVER]
)
```

For more information about the version and flow type configuration options, see Table 15–2.
The following sections provide examples of using the `@Transactional` annotation at the web service implementation class and method levels, and with the EJB `@TransactionAttribute` annotation.

- **Section 15.3.1.1, "Example: Using @Transactional Annotation on a Web Service Class"
- **Section 15.3.1.2, "Example: Using @Transactional Annotation on a Web Service Method"
- **Section 15.3.1.3, "Example: Using the @Transactional and the EJB @TransactionAttribute Annotations Together"

### 15.3.1.1 Example: Using @Transactional Annotation on a Web Service Class

The following example shows how to add `@Transactional` annotation on a web service class. Relevant code is shown in **bold**. As shown in the example, there is an active JTA transaction.

```java
package examples.webservices.jaxws.wsat.simple.service;

import weblogic.jws.Policy;
import javax.transaction.UserTransaction;
... import javax.jws.WebService;
import weblogic.wsee.wstx.wsat.Transactional;
import weblogic.wsee.wstx.wsat.Transactional.Version;
import weblogic.wsee.wstx.wsat.Transactional.TransactionFlowType;

/**
 * This JWS file forms the basis of a WebLogic WS-Atomic Transaction Web Service with the
 * operations: createAccount, deleteAccount, transferMonet, listAccount
 */

@WebService(serviceName = "WsatBankTransferService", targetNamespace = "http://tempuri.org/",
portName = "WSHttpBindingIService")
@Transactional(value=Transactional.TransactionFlowType.MANDATORY,
version=weblogic.wsee.wstx.wsat.Transactional.Version.WSAT10)
public class WsatBankTransferService {

public String createAccount(String acctNo, String amount) throws java.lang.Exception{
    Context ctx = null;
    UserTransaction tx = null;
    try {
        ctx = new InitialContext();
        tx = (UserTransaction)ctx.lookup("javax.transaction.UserTransaction");
        try {
            DataSource dataSource = (DataSource)ctx.lookup("examples-demoXA-2");
            String sql = "insert into wsat_acct_remote (acctno, amount) values (" + acctNo + ", " + amount + ");
            int insCount = dataSource.getConnection().prepareStatement(sql).executeUpdate();
            if (insCount != 1)
                throw new java.lang.Exception("insert fail at remote.");
        }
    }
}
```

**Note:** The following excerpt is borrowed from the web services atomic transaction example that is delivered with the WebLogic Server Samples Server. For more information, see Section 15.7, "More Examples of Using Web Services Atomic Transactions".
return ":acctno=" + acctNo + " amount=" + amount + " creating. ";
} catch (SQLException e) {
    System.out.println("**** Exception caught ****");
    e.printStackTrace();
    throw new SQLException("SQL Exception during createAccount() at remote.");
}
} catch (java.lang.Exception e) {
    System.out.println("**** Exception caught ****");
    e.printStackTrace();
    throw new java.lang.Exception(e);
}
}
public String deleteAccount(String acctNo) throws java.lang.Exception{
    ...
}
public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
    ...
}
public String listAccount() throws java.lang.Exception{
    ...
}
}

15.3.1.2 Example: Using @Transactional Annotation on a Web Service Method

The following example shows how to add @Transactional annotation on a web service implementation method. Relevant code is shown in bold.

```java
package examples.webservices.jaxws.wsat.simple.service;
import javax.transaction.UserTransaction;
import java.util.Properties;
public class WsatBankTransferService {
    @Transactional(value=Transactional.TransactionFlowType.MANDATORY,
    version=weblogic.jws.wstx.wsat.Transactional.Version.WSAT10)
    public String createAccount(String acctNo, String amount) throws java.lang.Exception{
        UserTransaction tx = null;
        try {
            tx = (UserTransaction)ctx.lookup("javax.transaction.UserTransaction");
            try {
                DataSource dataSource = (DataSource)ctx.lookup("examples-demoXA-2");
                String sql = "insert into wsat_acct_remote (acctno, amount) values (" + acctNo + " amount=" + amount + " creating. ");
                return ":acctno=" + acctNo + " amount=" + amount + " creating. ";
            } catch (SQLException e) {
                System.out.println("**** Exception caught ****");
                e.printStackTrace();
                throw new SQLException("SQL Exception during createAccount() at remote.");
            }
        } catch (java.lang.Exception e) {
            System.out.println("**** Exception caught ****");
            e.printStackTrace();
            throw new java.lang.Exception(e);
        }
    }
    public String deleteAccount(String acctNo) throws java.lang.Exception{
        ...
    }
    public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
        ...
    }
    public String listAccount() throws java.lang.Exception{
        ...
    }
}
```

package examples.webservices.jaxws.wsat.simple.service;
import weblogic.jws.Policy;
import javax.transaction.UserTransaction;
import javax.jws.WebService;
import weblogic.wsee.wstx.wsat.Transactional;
import weblogic.wsee.wstx.wsat.Transactional.Version;
import weblogic.wsee.wstx.wsat.Transactional.TransactionFlowType;

```java
/**
 * This JWS file forms the basis of a WebLogic WS-Atomic Transaction Web Service with the
 * operations: createAccount, deleteAccount, transferMoney, listAccount
 */

@WebService(serviceName = "WsatBankTransferService", targetNamespace = "http://tempuri.org/",
portName = "WSHttpBindingIIService")
public class WsatBankTransferService {
    @Transactional(value=Transactional.TransactionFlowType.MANDATORY,
    version=weblogic.jws.wstx.wsat.Transactional.Version.WSAT10)
    public String createAccount(String acctNo, String amount) throws java.lang.Exception{
        UserTransaction tx = null;
        try {
            tx = (UserTransaction)ctx.lookup("javax.transaction.UserTransaction");
            try {
                DataSource dataSource = (DataSource)ctx.lookup("examples-demoXA-2");
                String sql = "insert into wsat_acct_remote (acctno, amount) values (" + acctNo + " amount=" + amount + " creating. ");
                return ":acctno=" + acctNo + " amount=" + amount + " creating. ";
            } catch (SQLException e) {
                System.out.println("**** Exception caught ****");
                e.printStackTrace();
                throw new SQLException("SQL Exception during createAccount() at remote.");
            }
        } catch (java.lang.Exception e) {
            System.out.println("**** Exception caught ****");
            e.printStackTrace();
            throw new java.lang.Exception(e);
        }
    }
    public String deleteAccount(String acctNo) throws java.lang.Exception{
        ...
    }
    public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
        ...
    }
    public String listAccount() throws java.lang.Exception{
        ...
    }
}
public String deleteAccount(String acctNo) throws java.lang.Exception{
    ...
}

public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
    ...
}

public String listAccount() throws java.lang.Exception{
    ...
}

15.3.1.3 Example: Using the @Transactional and the EJB @TransactionAttribute Annotations Together

The following example illustrates how to use the @Transactional and EJB @TransactionAttribute annotations together. In this case, the flow type values must be compatible, as outlined in Table 15-3. Relevant code is shown in bold.
15.3.2 Enabling Web Services Atomic Transactions Starting From WSDL

When enabled, web services atomic transactions are advertised in the WSDL file using a policy assertion.

Table 15–4 summarizes the WS-AtomicTransaction 1.2 policy assertions that correspond to a set of common web services atomic transaction flow type and EJB Transaction attribute combinations. All other combinations result in a build-time error.

<table>
<thead>
<tr>
<th>Atomic Transaction Flow Type</th>
<th>EJB @TransactionAttribute</th>
<th>WS-AtomicTransaction 1.2 Policy Assertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANDATORY</td>
<td>MANDATORY, REQUIRED, SUPPORTS</td>
<td><a href="">wsat:ATAssertion/</a></td>
</tr>
<tr>
<td>SUPPORTS</td>
<td>REQUIRED, SUPPORTS</td>
<td>&lt;wsat:ATAssertion wsp:Optional=&quot;true&quot;/&gt;</td>
</tr>
<tr>
<td>NEVER</td>
<td>REQUIRED, REQUIRES_NEW, NEVER, SUPPORTS, NOT_SUPPORTED</td>
<td>No policy advertisement</td>
</tr>
</tbody>
</table>

You can use wsdlc Ant task to generate, from an existing WSDL file, a set of artifacts that together provide a partial Java implementation of the web service described by the WSDL file. The WS-AtomicTransaction policy assertions that are advertised in the WSDL are carried forward and are included in the WSDL file for the new web service generated by wsdlc.

The wsdlc Ant tasks creates a JWS file that contains a partial (stubbed-out) implementation of the generated JWS interface. You need to modify this file to include your business code. After you have coded the JWS file with your business logic, run the jwsc Ant task to generate a complete Java implementation of the web service. Use the compiledWsdl attribute of jwsc to specify the JAR file generated by the wsdlc Ant task which contains the JWS interface file and data binding artifacts. By specifying this attribute, the jwsc Ant task does not generate a new WSDL file but instead uses the one in the JAR file. Consequently, when you deploy the web service and view its WSDL, the deployed WSDL will look just like the one from which you initially started (with the WS-AtomicTransaction policy assertions).

For complete details about using wsdlc to generate a web service from a WSDL file, see Section 3.4, "Developing WebLogic Web Services Starting From a WSDL File: Main Steps."

15.4 Enabling Web Services Atomic Transactions on Web Service Clients

On a web service client, enable web services atomic transactions using one of the following methods:

- Add the @weblogic.wsee.wstx.wsat.Transactional annotation on the web service reference injection point for a client. For more information, see Section 15.4.1, "Using @Transactional Annotation with the @WebServiceRef Annotation".
- Pass an instance of the weblogic.wsee.wstx.wsat.TransactionalFeature as a parameter when creating the web service proxy or dispatch. For more information,
see Section 15.4.2, "Passing the TransactionalFeature to the Client".

■ At deployment time, enable and configure web services atomic transactions at the web service client endpoint or method level using the WebLogic Server Administration Console. For more information, see Section 15.5, "Configuring Web Services Atomic Transactions Using the Administration Console".

■ At run-time, if the non-atomic transactional web service client calls an atomic transaction-enabled web service, then based on the flow type advertised in the WSDL:
  – If the flow type is set to SUPPORTS or NEVER on the service-side, then the call is included as part of the transaction.
  – If the flow type is set to MANDATORY, then an exception is thrown.

__________

**Note:** Web services atomic transactions are not supported by Java SE clients.

__________

For information about the configuration options that you can set when enabling web services atomic transactions, see Table 15–2.

**15.4.1 Using @Transactional Annotation with the @WebServiceRef Annotation**

To enable web services atomic transactions, specify the @weblogic.wsee.wstx.wsat.Transactional annotation on the web service client at the web service reference (@WebServiceRef) injection point.

The format for specifying the @Transactional annotation is as follows:

```java
@Transactional(
    version=Transactional.Version.[WSAT10|WSAT11|WSAT12|DEFAULT],
    value=Transactional.TransactionFlowType.[MANDATORY|SUPPORTS|NEVER]
)
```

For more information about the version and flow type configuration options, see Table 15–2.

The following example illustrates how to annotate the web service reference injection point. Relevant code is shown in **bold**. As shown in the example, the active JTA transaction becomes a part of the atomic transaction.

__________

**Note:** The following excerpt is borrowed from the web services atomic transaction example that is delivered with the WebLogic Server Samples Server. For more information, see Section 15.7, "More Examples of Using Web Services Atomic Transactions".

```java
package examples.webservices.jaxws.wsat.simple.client;

import javax.servlet.*;
import javax.servlet.http.*;
import java.net.URL;
import javax.xml.namespace.QName;
import javax.transaction.UserTransaction;
import javax.transaction.SystemException;
```

15-10   Developing JAX-WS Web Services for Oracle WebLogic Server
import javax.xml.ws.WebServiceRef;
import weblogic.wsee.wstx.wsat.Transactional;

/**
   * This example demonstrates using a WS-Atomic Transaction to create or delete an account,
   * or transfer money via web service as a single atomic transaction.
   */

public class WsatBankTransferServlet extends HttpServlet {
    ...
    String url = "http://localhost:7001";
    URL wsdlURL = new URL(url + "/WsatBankTransferService/WsatBankTransferService");
    ...
    DataSource ds = null;
    UserTransaction utx = null;
    try {
        ctx = new InitialContext();
        utx = (UserTransaction) ctx.lookup("javax.transaction.UserTransaction");
        utx.setTransactionTimeout(900);
    } catch (java.lang.Exception e) {
        e.printStackTrace();
    }
    WsatBankTransferService port = getWebService(wsdlURL);
    try {
        utx.begin();
        if (remoteAccountNo.length() > 0) {
            if (action.equals("create")) {
                result = port.createAccount(remoteAccountNo, amount);
            } else if (action.equals("delete")) {
                result = port.deleteAccount(remoteAccountNo);
            } else if (action.equals("transfer")) {
                result = port.transferMoney(remoteAccountNo, amount, direction);
            }
        }
        utx.commit();
        result = "The transaction is committed " + result;
    } catch (java.lang.Exception e) {
        try {
            e.printStackTrace();
            utx.rollback();
            result = "The transaction is rolled back.    " + e.getMessage();
        } catch(java.lang.Exception ex) {
            e.printStackTrace();
            result = "Exception is caught. Check stack trace.";
        }
    }
    request.setAttribute("result", result);
    ...
    @Transactional(value = Transactional.TransactionFlowType.MANDATORY,
                   version = Transactional.Version.WSAT10)
    WsatBankTransferService_Service service;
    private WsatBankTransferService getService() {
        return service.getWSHttpBindingIService();
    }
}
15.4.2 Passing the TransactionalFeature to the Client

To enable web services atomic transactions on the client of the web service, you can pass an instance of the `weblogic.wsee.wstx.wsat.TransactionalFeature` as a parameter when creating the web service proxy or dispatch, as illustrated in the following example. Relevant code is shown in **bold**.

```java
package examples.webservices.jaxws.wsat.simple.client;

import javax.servlet.
import javax.servlet.http.

public String createAccount(String acctNo, String amount) throws java.lang.Exception{
    Context ctx = null;
    UserTransaction tx = null;
    try {
        ctx = new InitialContext();
        tx = (UserTransaction)ctx.lookup("javax.transaction.UserTransaction");
        try {
            DataSource dataSource = (DataSource)ctx.lookup("examples-dataSource-demoXAPool");
            String sql = "insert into wsat_acct_local (acctno, amount) values (  
            " + acctNo + ", " + amount + ")";
            int insCount = dataSource.getConnection().prepareStatement(sql).executeUpdate();
            if (insCount != 1)
                throw new java.lang.Exception("insert fail at local.");
            return ":acctno=" + acctNo + ", amount=" + amount + " creating...

            } catch (SQLException e) {
                System.out.println("**** Exception caught *****");
                e.printStackTrace();
                throw new SQLException("SQL Exception during createAccount() at local.");
            }
            } catch (java.lang.Exception e) {
                System.out.println("**** Exception caught *****");
                e.printStackTrace();
                throw new java.lang.Exception(e);
            }
        }

        public String deleteAccount(String acctNo) throws java.lang.Exception{
            ...
        }

        public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
            ...
        }

        public String listAccount() throws java.lang.Exception{
            ...
        }
    }
}
```

**Note:** The following excerpt is borrowed from the web services atomic transaction example that is delivered with the WebLogic Server Samples Server. For more information, see Section 15.7, "More Examples of Using Web Services Atomic Transactions".

```
package examples.webservices.jaxws.wsat.simple.client;

import javax.servlet.*;
import javax.servlet.http.*;
```
import java.net.URL;
import javax.xml.namespace.QName;
import javax.transaction.UserTransaction;
import javax.transaction.SystemException;
import weblogic.wsee.wstx.wsat.TransactionalFeature;
import weblogic.wsee.wstx.wsat.Transactional.Version;
import weblogic.wsee.wstx.wsat.Transactional.TransactionFlowType;

/**
 * This example demonstrates using a WS-Atomic Transaction to create or delete an account,
 * or transfer money via web service as a single atomic transaction.
 */

public class WsatBankTransferServlet extends HttpServlet {

    String url = "http://localhost:7001";
    URL wsdlURL = new URL(url + "/WsatBankTransferService/WsatBankTransferService");

    DataSource ds = null;
    UserTransaction utx = null;

    try {
        ctx = new InitialContext();
        utx = (UserTransaction) ctx.lookup("javax.transaction.UserTransaction");
        utx.setTransactionTimeout(900);
    } catch (java.lang.Exception e) {
        e.printStackTrace();
    }

    WsatBankTransferService port = getWebService(wsdlURL);

    try {
        utx.begin();
        if (remoteAccountNo.length() > 0) {
            if (action.equals("create")) {
                result = port.createAccount(remoteAccountNo, amount);
            } else if (action.equals("delete")) {
                result = port.deleteAccount(remoteAccountNo);
            } else if (action.equals("transfer")) {
                result = port.transferMoney(remoteAccountNo, amount, direction);
            }
        }
        utx.commit();
        result = "The transaction is committed " + result;
    } catch (java.lang.Exception e) {
        try {
            e.printStackTrace();
            utx.rollback();
            result = "The transaction is rolled back. " + e.getMessage();
        } catch (java.lang.Exception ex) {
            e.printStackTrace();
            result = "Exception is caught. Check stack trace.";
        }
    }

    request.setAttribute("result", result);

    // Passing the TransactionalFeature to the Client
private WsatBankTransferService getWebService(URL wsdlURL) {
    TransactionalFeature feature = new TransactionalFeature();
    feature.setFlowType(TransactionFlowType.MANDATORY);
    feature.setVersion(Version.WSAT10);
    WsatBankTransferService_Service service = new WsatBankTransferService_Service(wsdlURL,
        new QName("http://tempuri.org/", "WsatBankTransferService"));
    return service.getWSHttpBindingIService(new javax.xml.ws.soap.AddressingFeature(),
        feature);
}

public String createAccount(String acctNo, String amount) throws java.lang.Exception{
    Context ctx = null;
    UserTransaction tx = null;
    try {
        ctx = new InitialContext();
        tx = (UserTransaction)ctx.lookup("javax.transaction.UserTransaction");
        try {
            DataSource dataSource = (DataSource)ctx.lookup("examples-dataSource-demoXAPool");
            String sql = "insert into wsat_acct_local (acctno, amount) values (" + acctNo + ", " + amount + ");"
            int insCount = dataSource.getConnection().prepareStatement(sql).executeUpdate();
            if (insCount != 1)
                throw new java.lang.Exception("insert fail at local.");
            return "acctno=" + acctNo + " amount=" + amount + " creating.. ";
        } catch (SQLException e) {
            System.out.println("**** Exception caught *****");
            e.printStackTrace();
            throw new SQLException("SQL Exception during createAccount() at local.");
        }
    } catch (java.lang.Exception e) {
        System.out.println("**** Exception caught *****");
        e.printStackTrace();
        throw new java.lang.Exception(e);
    }
}

public String deleteAccount(String acctNo) throws java.lang.Exception{
    ...
}

public String transferMoney(String acctNo, String amount, String direction) throws java.lang.Exception{
    ...
}

public String listAccount() throws java.lang.Exception{
    ...
}

15.5 Configuring Web Services Atomic Transactions Using the Administration Console

The following sections describe how to configure web services atomic transactions using the WebLogic Server Administration Console.

- Section 15.5.1, "Securing Messages Exchanged Between the Coordinator and Participant"
- Section 15.5.2, "Enabling and Configuring Web Services Atomic Transactions"
15.5.1 Securing Messages Exchanged Between the Coordinator and Participant

Using transport-level security, you can secure messages exchanged between the web services atomic transaction coordinator and participant by configuring the properties defined in the following table using the WebLogic Server Administration Console. These properties are configured at the domain level. For detailed steps, see "Configure web services atomic transactions" in the Oracle WebLogic Server Administration Console Online Help.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
</table>
| Web Services Transactions Transport Security Mode | Specifies whether two-way SSL is used for the message exchange between the coordinator and participant. This property can be set to one of the following values:  
  - SSL Not Required—All web service transaction protocol messages are exchanged over the HTTP channel.  
  - SSL Required—All web service transaction protocol messages are exchanged over the HTTPS channel. This flag must be enabled when invoking Microsoft .NET web services that have atomic transactions enabled.  
  - Client Certificate Required—All web service transaction protocol messages are exchanged over HTTPS and a client certificate is required. For more information, see "Configure two-way SSL" in the Oracle WebLogic Server Administration Console Online Help. |
| Web Service Transactions Issued Token Enabled | Flag the specifies whether to use an issued token to enable authentication between the coordinator and participant. The IssuedToken is issued by the coordinator and consists of a security context token (SCT) and a session key used for signing. The participant sends the signature, signed using the shared session key, in its registration message. The coordinator authenticates the participant by verifying the signature using the session key. |

15.5.2 Enabling and Configuring Web Services Atomic Transactions

To enable web services atomic transactions and configure the version and flow type, you can customize the configuration at the endpoint or method level for the web service or client. For detailed steps, see "Configure web services atomic transactions" in the Oracle WebLogic Server Administration Console Online Help.

15.6 Using Web Services Atomic Transactions in a Clustered Environment

For considerations when using atomic transaction-enabled web services in a clustered environment, see Chapter 23, "Managing Web Services in a Cluster."

15.7 More Examples of Using Web Services Atomic Transactions

Refer to the following sections for additional examples of using web services atomic transactions:
For an example of how to sign and encrypt message headers exchanged during the web services atomic transaction, see "Securing Web Services Atomic Transactions" in Securing WebLogic Web Services for Oracle WebLogic Server.

**Note:** You can secure applications that enable web service atomic transactions using only WebLogic web service security policies. You cannot secure them using Oracle Web Services Manager (WSM) policies.

A detailed example of web services atomic transactions is provided as part of the WebLogic Server sample application. For more information about running the sample application and accessing the example, see "Sample Application and Code Examples" in Understanding Oracle WebLogic Server.
This chapter describes how to use Fast Infoset for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Overview of Fast Infoset
- Enabling Fast Infoset on Web Services
- Enabling and Configuring Fast Infoset on Web Services Clients
- Disabling Fast Infoset on Web Services and Clients

16.1 Overview of Fast Infoset

Fast Infoset is a compressed binary encoding format that provides a more efficient serialization than the text-based XML format. Fast Infoset optimizes both document size and processing performance.

When enabled, Fast Infoset converts the XML Information Set in the SOAP envelope into a compressed binary format before transmitting the data. Fast Infoset optimizes encrypted and signed messages, MTOM-enabled messages, and SOAP attachments, and supports both HTTP and JMS transports.

The Fast Infoset specification, ITU-T Rec. X.891 and ISO/IEC 24824-1 (Fast Infoset) is defined by both the ITU-T and ISO standards bodies. The specification can be downloaded from the ITU Web site: http://www.itu.int/rec/T-REC-X.891-200505-I/en

The Fast Infoset capability is enabled on all web services, by default. For web service clients, Fast Infoset is enabled if it is enabled on the web service and advertised in the WSDL.

You can explicitly enable and configure Fast Infoset on a web service or client, as described in the following sections.

16.2 Enabling Fast Infoset on Web Services

The Fast Infoset capability is enabled on a web service and advertised in the WSDL, by default. You can enable Fast Infoset explicitly on a web service, using one of the following methods:

- At design time, using com.oracle.webservices.api.FastInfosetService annotation, as shown in "Example Using @FastInfosetService Annotation at
Enabling and Configuring Fast Infoset on Web Services Clients

Design Time” on page 16-2. For more information about the annotation, see
"@FastInfosetService" in Securing Web Services and Managing Policies with Oracle
Web Services Manager.

- Post-deployment, by attaching the oracle/fast_infoset_service_policy to the
  web service. For more information, see the following sections:
  - "Attaching Policies to Web Services and Clients Using Fusion Middleware
    Control” in Securing Web Services and Managing Policies with Oracle Web Services
    Manager
  - "Configuring Fast Infoset Using WLST" in Administering Web Services
  - "oracle/fast_infoset_service_policy" in Securing Web Services and Managing
    Policies with Oracle Web Services Manager

Example Using @FastInfosetService Annotation at Design Time
The following code excerpt provides an example of using the
com.oracle.webservices.api.FastInfosetService annotation to enable and
configure Fast Infoset on a web service at design time.

```java
package examples.webservices.hello_world;
import javax.jws.WebService;
import com.oracle.webservices.api.FastInfosetService;
@WebService(name="HelloWorldPortType", serviceName="HelloWorldService")
@FastInfosetService(enabled=true)
public class HelloWorldImpl {
    public String sayHelloWorld(String message) {
        try {
            System.out.println("sayHelloWorld:" + message);
        } catch (Exception ex) { ex.printStackTrace(); }
        return "Message from FI Enabled Service: '" + message + "'";
    }
}
```

16.3 Enabling and Configuring Fast Infoset on Web Services Clients
You can explicitly enable and configure Fast Infoset on a web service client, using one
of the following methods:

- At design time, using com.oracle.webservices.api.FastInfosetClientFeature
  feature class, as shown in "Example Using FastInfosetClientFeature Feature Class
  at Design Time" on page 16-3.

- Post-deployment, by attaching oracle/fast_infoset_client_policy to the web
  service. For more information, see the following sections:
  - "Attaching Policies to Web Services and Clients Using Fusion Middleware
    Control” in Securing Web Services and Managing Policies with Oracle Web Services
    Manager
  - "Configuring Fast Infoset Using WLST" in Administering Web Services
  - "oracle/fast_infoset_client_policy" in Securing Web Services and Managing
    Policies with Oracle Web Services Manager
16.3.1 Configuring the Content Negotiation Strategy

When enabling Fast Infoset on the client, you can configure the content negotiation policy. Table 16–1 summarizes the valid content negotiation strategies defined by com.oracle.webservices.api.FastInfosetContentNegotiationType.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTIMISTIC</td>
<td>Assumes that Fast Infoset is enabled on the service. All requests will be sent using Fast Infoset.</td>
</tr>
<tr>
<td>PESSIMISTIC</td>
<td>Initial request from client is sent without Fast Infoset enabled, but with an HTTP Accept header that indicates that the client supports the Fast Infoset capability. If the service response is in Fast Infoset format, confirming that Fast Infoset is enabled on the service, then subsequent requests from the client will be sent in Fast Infoset format.</td>
</tr>
<tr>
<td>NONE</td>
<td>Client requests will not use Fast Infoset.</td>
</tr>
</tbody>
</table>

Please note:

- If the content negotiation strategy is configured explicitly on the client:
  - It takes precedence over the negotiation strategy advertised in the WSDL.
  - If the configured content negotiation strategy conflicts with the capabilities advertised by the service (for example, if the client configures OPTIMISTIC and the service has Fast Infoset disabled), then an exception is generated.

- If the content negotiation strategy is not configured explicitly by the client:
  - If Fast Infoset is enabled and advertised on the service, the OPTIMISTIC content negotiation strategy is used.
  - If Fast Infoset is disabled and not advertised on the service, the NONE content negotiation strategy is used.

16.3.2 Example Using FastInfosetClientFeature Feature Class at Design Time

The following code excerpt provides an example of using the com.oracle.webservices.api.FastInfosetClientFeature feature class to enable and configure Fast Infoset on a web service at design time.

```java
package examples.webservices.hello_world.client;

import javax.xml.namespace.QName;
import java.net.MalformedURLException;
import java.net.URL;
import com.oracle.webservices.api.FastInfosetClientFeature;
import com.oracle.webservices.api.FastInfosetContentNegotiationType;

public class Main {
    public static void main(String[] args) {
        HelloWorldService service;
        FastInfosetContentNegotiationType clientNeg = FastInfosetContentNegotiationType.PESSIMISTIC;
        FastInfosetClientFeature feature = FastInfosetClientFeature.builder().fastInfosetContentNegotiation(clientNeg).enabled(true).build();
        try {
```
16.4 Disabling Fast Infoset on Web Services and Clients

At design time, to disable Fast Infoset explicitly:

- On a web service, set the enabled flag to false on the annotation, as described in "Enabling Fast Infoset on Web Services" on page 16-1.
- On a web service client, set the enabled flag to false or set the content negotiation strategy to NONE on the annotation or Feature class, as described in "Enabling and Configuring Fast Infoset on Web Services Clients" on page 16-2.

The following code excerpt provides an example of using the com.oracle.webservices.api.FastInfosetService annotation to disable Fast Infoset on a web service at design time.

```java
package examples.webservices.hello_world;
import javax.jws.WebService;
import com.oracle.webservices.api.FastInfosetService;

@WebService(name="HelloWorldPortType", serviceName="HelloWorldService")
@FastInfosetService(enabled=false)
public class HelloWorldImpl {
    public String sayHelloWorld(String message) {
        try {
            System.out.println("sayHelloWorld:' + message);
        } catch (Exception ex) { ex.printStackTrace(); }
        return "Message from FI Enabled Service: '" + message + ":";
    }
}
```

At post-deployment time, to disable Fast Infoset:

- Detach the oracle/fast_infoset_service_policy or oracle/fast_infoset_client_policy policy from the web service or client, respectively.

For complete details, see the following sections:


- To disable Fast Infoset globally, at a higher scope on a web service or client, define a policy set that includes oracle/no_fast_infoset_service_policy or oracle/no_fast_infoset_client_policy policy, respectively.

For complete details, see the following sections:

This chapter describes how to use SOAP over Java Messaging Service (JMS) transport as the connection protocol for WebLogic web services using Java API for XML Web Services (JAX-WS).

Note: SOAP over JMS transport is not compatible with the following web service features: reliable messaging and HTTP transport-specific security.

This chapter includes the following sections:

- Overview of SOAP Over JMS Transport
- Configuring the WebLogic Server Domain for JMS Transport
- Developing Web Services Using JMS Transport—Starting From Java
- Developing Web Services Using JMS Transport—Starting From WSDL
- Invoking a WebLogic Web Service Using JMS Transport
- Configuring JMS Transport Properties
- Monitoring SOAP Over JMS Transport

17.1 Overview of SOAP Over JMS Transport

Typically, web services and clients communicate using SOAP over HTTP/S as the connection protocol. You can, however, configure a WebLogic web service so that client applications use JMS as the transport.

Using SOAP over JMS transport, web services and clients communicate using JMS destinations instead of HTTP connections, offering the following benefits:

- Reliability
- Scalability
- Quality of service

As with web service reliable messaging, if WebLogic Server goes down while the method invocation is still in the queue, it will be handled as soon as WebLogic Server is restarted. When a client invokes a web service, the client does not wait for a response, and the execution of the client can continue. Using SOAP over JMS transport does require slightly more overhead and programming complexity than HTTP/S.

For each transport that you specify, WebLogic Server generates an additional port in the WSDL. For this reason, if you want to give client applications a choice of transports
they can use when they invoke the web service (JMS, HTTP, or HTTPS), you should explicitly configure each transport. You configure transports using JWS annotations or child elements of the jwsc Ant task.

If you configure JMS transport only, although you cannot invoke the web service using HTTP, you can view its WSDL using HTTP, which is how the clientgen is still able to generate JAX-WS stubs for the web service.

---

**Note:** Using JMS transport is a WebLogic feature; non-WebLogic client applications, such as a .NET client, may not be able to invoke the web service using the JMS port.

---

Figure 17–1 shows the flow of request and response messages for a web service invocation using SOAP over JMS transport.

- The client stub invokes the web service and sends the SOAP request message to the web service via the JMS request queue, and then waits for the response.
- On the server side, the MDB listener receives the request and invokes the service endpoint.
- Once processed, the service endpoint sends the response to the JMS response queue.
- The JMS listener on the client side receives the response and passes it to the client.
- The JMS response endpoint and listener are removed when the client issues the java.io.Closable.close() command.

---

**Figure 17–1 Web Service Invocation Using SOAP Over JMS Transport**

---

Figure 17–2 shows the flow of request and response messages for an asynchronous web service invocation using SOAP over JMS transport.

- The client stub invokes the web service asynchronously and sends the SOAP request message to the web service via the JMS request queue. The client stub returns a javax.xml.ws.Response or java.util.concurrent.Future<T> instance, and does not wait for the response.
- On the server side, the MDB listener receives the request and invokes the service endpoint.
- Once processed, the service endpoint sends the response to the JMS response queue.
- The JMS listener invokes the response endpoint which populates the Response or Future<T> instance for the client.
- The JMS response endpoint and listener are removed when the client issues the java.io.Closable.close() command.
Before sending the request message to the JMS destination, the client sets the JMS message properties defined in Table 17–1.

**Table 17–1 JMS Message Properties Defined in the Request Message**

<table>
<thead>
<tr>
<th>JMS Message Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOAPJMS_bindingVersion</td>
<td>Version of the SOAP JMS binding. This value must be set to 1.0 for this release.</td>
</tr>
<tr>
<td>SOAPJMS_contentType</td>
<td>MIME content type of the message</td>
</tr>
<tr>
<td>SOAPJMS_requestURI</td>
<td>JMS request URI. For more information about how the value is configured, see Section 17.6.6, &quot;Configuring the JMS Request URI.&quot;</td>
</tr>
<tr>
<td>SOAPJMS_soapAction</td>
<td>SOAP action which defines the intent of the request.</td>
</tr>
<tr>
<td>SOAPJMS_targetService</td>
<td>Port component name of the web service.</td>
</tr>
<tr>
<td>messageType</td>
<td>Message type to use with the request message. A value of BYTES indicates the com.oracle.webservices.api.jms.JMSMessageType.BYTES object is used. A value of TEXT indicates com.oracle.webservices.api.jms.JMSMessageType.TEXT object is used. This value defaults to BYTES.</td>
</tr>
<tr>
<td>JMSMessageID</td>
<td>ID that uniquely identifies the JMS message and that is used to correlate the response message with the request. The JMSCorrelationID property of the response message must match the JMSMessageID of the request message.</td>
</tr>
<tr>
<td>ECIDContext</td>
<td>Execution Context Identifier (ECID), wrapper code, and encoding details. This content is similar to what is provided for the HTTP header, and is required for the client only.</td>
</tr>
</tbody>
</table>

Before sending the response message to the JMS destination, the service sets the JMS message properties defined in Table 17–1.

**Table 17–2 JMS Message Properties Defined in the Response Message**

<table>
<thead>
<tr>
<th>JMS Message Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOAPJMS_bindingVersion</td>
<td>Version of the SOAP JMS binding. This value must be set to 1.0 for this release.</td>
</tr>
<tr>
<td>SOAPJMS_contentType</td>
<td>MIME content type of the message</td>
</tr>
<tr>
<td>JMSCorrelationID</td>
<td>ID used to correlate the request and response messages. The JMSCorrelationID must match the JMSMessageID of the request message.</td>
</tr>
<tr>
<td>JMSMessageID</td>
<td>ID that uniquely identifies the JMS message and that is used to correlate the response message with the request.</td>
</tr>
</tbody>
</table>
17.2 Configuring the WebLogic Server Domain for JMS Transport

Table 17–3 lists the default resources used by JMS transport in your WebLogic Server domain, by default.

<table>
<thead>
<tr>
<th>Resource Name (Default)</th>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WseeSoapjmsJmsServer</td>
<td>JMS server</td>
<td>JMS server management container. To configure the JMS server manually, see &quot;JMS Configuration&quot; in Administering JMS Resources for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>WseeSoapjmsFileStore</td>
<td>File store</td>
<td>File store, or physical store, used by the WebLogic Server to handle the I/O operations to save and retrieve data from the physical storage (such as file, DBMS, and so on). To configure the file stores manually, see Administering the WebLogic Persistent Store.</td>
</tr>
<tr>
<td>WseeSoapjmsJmsModule</td>
<td>JMS Module</td>
<td>JMS module that defines the JMS resources needed for SOAP over JMS transport. To configure the JMS module manually, see &quot;JMS Configuration&quot; in Administering JMS Resources for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>WseeSoapjmsJmsServerSub</td>
<td>JMS subdeployment</td>
<td>JMS subdeployment for targeting the JMS resources to the WseeSoapJmsServer. To configure the JMS subdeployment manually, see &quot;JMS Configuration&quot; in Administering JMS Resources for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>com.oracle.webservices.api.jms.ConnectionFactory</td>
<td>JMS Connection Factory</td>
<td>Default JMS connection factory used to create connections for SOAP over JMS transport. You can configure a different connection factory using the jndiConnectionFactoryName JMS transport property, as described in Section 17.6, &quot;Configuring JMS Transport Properties.&quot;</td>
</tr>
<tr>
<td>com.oracle.webservices.api.jms.RequestQueue</td>
<td>JMS Queue</td>
<td>Default JMS request queue. You can configure a different JMS request queue using the destinationName JMS transport property, as described in Section 17.6, &quot;Configuring JMS Transport Properties.&quot;</td>
</tr>
<tr>
<td>com.oracle.webservices.api.jms.ResponseQueue</td>
<td>JMS Queue</td>
<td>Default JMS response queue. You can configure a different JMS response queue, as described in Section 17.6.8, &quot;Configuring the JMS Response Queue.&quot;</td>
</tr>
</tbody>
</table>

When creating or extending a domain, you can apply the WebLogic JAX-WS SOAP/JMS Extension template (wls_webservice_soapjms.jar) to configure automatically the JMS resources required to support JMS transport.

To configure automatically the JMS resources required to support JMS transport, use one of the following methods:

- Use the Configuration Wizard to create or extend a domain, as described in Creating WebLogic Domains Using the Configuration Wizard. When prompted to specify a template to use to create or extend the domain, select the WebLogic JAX-WS SOAP/JMS Extension template.
Use WLST to extend a domain, using the \texttt{wls_webserviceSoapJms.jar} extension template JAR file, as described in ”Editing a WebLogic Domain (Offline)” in \textit{Understanding the WebLogic Scripting Tool}.

Although use of this extension template is not required, it makes the configuration of the required resources much easier. Alternatively, you can manually configure the resources required using the Oracle WebLogic Server Administration Console or WLST.

To configure manually the resources required to support JMS transport, use one of the following methods:

- Use the WebLogic Server Administration Console to create the resources, as described in \textbf{Table 17–3}. For more information, see ”JMS Configuration” in \textit{Administering JMS Resources for Oracle WebLogic Server}.
- Use WLST to create the resources defined in \textbf{Table 17–3}. For more information, see ”Creating Existing WebLogic Domains” in \textit{Understanding the WebLogic Scripting Tool}.

### 17.3 Developing Web Services Using JMS Transport—Starting From Java

To use JMS transport for web services when starting from Java, you must perform at least one of the following tasks:

- Add the \texttt{@com.oracle.webservices.api.jms.JMSTransportService} annotation to your JWS file.
- Add a \texttt{<jmstransportservice>} child element in the \texttt{<jws>} element of the \texttt{jwsc} Ant task. This setting overrides the transports defined in the JWS file.

The following procedure describes the complete set of steps required so that your web service can be invoked using the JMS transport when starting from Java.

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complete the prerequisites.</td>
<td>It is assumed that you have created a basic JWS file that implements a web service and that you want to configure the web service to be invoked using JMS transport. It is also assumed that you have set up an Ant-based development environment and that you have a working \texttt{build.xml} file that includes targets for running the \texttt{jwsc} Ant task and deploying the service. For more information, see Chapter 3, &quot;Developing JAX-WS Web Services.&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Configure the WebLogic Server domain for the required JMS components.</td>
<td>See Section 17.2, ”Configuring the WebLogic Server Domain for JMS Transport.”.</td>
</tr>
<tr>
<td>3</td>
<td>Add the \texttt{@com.oracle.webservices.api.jms.JMSTransportService} annotation to your JWS file. (Optional)</td>
<td>This step is optional. If you do not add the \texttt{@JMSTransportService} annotation to your JWS file, then you must add a \texttt{&lt;jmstransportservice&gt;} child element in the \texttt{&lt;jws&gt;} element of the \texttt{jwsc} Ant task, as described in Step 4. See Section 17.3.1, &quot;Using the \texttt{@JMSTransportService Annotation}&quot;.</td>
</tr>
</tbody>
</table>
Developing Web Services Using JMS Transport—Starting From Java

See Section 17.5, "Invoking a WebLogic Web Service Using JMS Transport" for information about updating your client application to invoke the web service using JMS transport.

### 17.3.1 Using the @JMSTransportService Annotation

If you know at the time that you program the JWS file that you want client applications to use JMS transport (instead of HTTP/S) to invoke the web service, you can use the `@com.oracle.webservices.api.jms.JMSTransportService` annotation to specify the details of the invocation.

You can include only one `@JMSTransportService` annotation in a JWS file.

Optionally, you can configure the destination name, connection factory, delivery mode, and other JMS transport properties using the `@JMSTransportService` annotation. For more information, see Section 17.6, "Configuring JMS Transport Properties".

Later, at build-time, you can override the invocation defined in the JWS file and add additional JMS transport specifications, by specifying the `<jmstransportservice>` child element in the `<jws>` element of "jws" `jwsc` Ant task, as described in Section 17.3.2, "Using the <jmstransportservice> Child Element in the Ant build.xml File".

Example 17–1 shows an excerpt from a JWS file, implemented as a stateless EJB, that uses the `@JMSTransportService` annotation, with the relevant code in bold.

**Example 17–1 Enabling JMS Transport for a Stateless EJB Using @JMSTransportService Annotation**

```java
package jaxws.ejb;
...
import javax.ejb.Stateless;
import javax.jws.WebService;
import com.oracle.webservices.api.jms.JMSTransportService;

@WebService(name = "Simple", targetNamespace = "http://example.org")
@JMSTransportService(
    targetService="SimpleEjbService",
    destinationName="com.oracle.webservices.api.jms.RequestQueue",
    jndiConnectionFactoryName="weblogic.jms.ConnectionFactory",
    mdbPerDestination=false,
    activationConfig="transAttribute=Never;maxBeansInFreePool=1000;
    dispatchPolicy=weblogic.wsee.jaxws.mdb.DispatchPolicy"
)
```

---

### Table 17–4 (Cont.) Steps to Develop Web Services With JMS Transport—Starting From Java

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Add a <code>&lt;jmstransportservice&gt;</code> child element to the <code>jwsc</code> Ant task. (Optional)</td>
<td>Use the <code>&lt;jmstransportservice&gt;</code> child element to override the transports defined in the JWS file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This step is required if you did not add the <code>@JmsTransportService</code> annotation to your JWS file in Step 3. Otherwise, this step is optional.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See Section 17.3.2, &quot;Using the &lt;jmstransportservice&gt; Child Element in the Ant build.xml File&quot; for details.</td>
</tr>
<tr>
<td>5</td>
<td>Build your web service by running the target in the <code>build.xml</code> Ant file that calls the <code>jwsc</code> task.</td>
<td>For example, if the target that calls the <code>jwsc</code> Ant task is called <code>build-service</code>, then you would run:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>prompt&gt; ant build-service</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See Section 3.6, &quot;Running the <code>jwsc</code> WebLogic Web Services Ant Task.&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Deploy your web service to WebLogic Server.</td>
<td>See Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services.&quot;</td>
</tr>
</tbody>
</table>

See Section 17.5, "Invoking a WebLogic Web Service Using JMS Transport" for information about updating your client application to invoke the web service using JMS transport.
Example 17–2 shows an excerpt from a provider-based web service that uses the @JMSTransportService annotation, with the relevant code in bold.

Example 17–2  Enabling JMS Transport for a Provider-based Web Service Using @JMSTransportService Annotation

```java
package examples.webservices.jaxws;
...
import javax.xml.transform.Source;
import javax.xml.ws.Provider;
import javax.xml.ws.ServiceMode;
import javax.xml.ws.WebServiceProvider;
import javax.xml.ws.Service;
import java.io.ByteArrayInputStream;
import com.oracle.webservices.api.jms.JMSTransportService;
@ServiceMode(value=Service.Mode.PAYLOAD)
@WebServiceProvider(portName="WarehouseServicePort",
serviceName="WarehouseService",targetNamespace="http://examples.org/")
@JMSTransportService(destinationName="myQueue")
public class WarehouseServiceImpl implements Provider<Source> {
    public Source invoke(Source source) { ... }
}
```

17.3.2 Using the <jmstransportservice> Child Element in the Ant build.xml File

You can specify the JMS transport at build-time by adding the <jmstransportservice> child element in the <jws> element of the jwsc Ant task. You may want to configure JMS transport at build-time for one of the following reasons:

- You want to override the attribute values specified in the JWS file using the @JMSTransportService annotation.
- The JWS file does not include a @JMSTransportService annotation and you determine at build-time that you want clients to use the JMS transport to invoke the web service.

The <jmstransportservice> child element of the jwsc Ant task takes precedence over the @JMSTransportService transport annotation in the JWS file.

Optionally, you can configure the destination name, destination type, delivery mode, and other JMS transport properties, using the <jmstransportservice> element. For a complete list of JMS transport properties supported, see Section 17.6, "Configuring JMS Transport Properties."

Example 17–3 shows an excerpt from a build.xml file that shows how to enable and configure JMS transport using the <jmstransportservice> child element in the <jws> element of the jwsc Ant task. The relevant code is shown in bold.

Example 17–3  Enabling JMS Transport Using the <jmstransportservice> Child Element

```xml
<?xml version="1.0"?>
<project name="jaxws.jms.jwsc" default="all">
    <import file="../build-jms.xml"/>
```
For more information about using the jwsc Ant task, see "jwsc" in WebLogic Web Services Reference for Oracle WebLogic Server.

17.4 Developing Web Services Using JMS Transport—Starting From WSDL

To use JMS transport for web services when starting from WSDL, you must perform at least one of the following tasks:

- Update the WSDL to use JMS transport before running the wsdlc Ant task.
- Update the stubbed-out JWS implementation file generated by the wsdlc Ant task to add the @com.oracle.webservices.api.jms.JMSTransportService annotation.
- Add a <jmstransportservice> child element in the <jws> element of the jwsc Ant task used to build the JWS implementation file. This setting overrides the transports defined in the JWS file.

The following procedure describes the complete set of steps required so that your web service can be invoked using the JMS transport when starting from WSDL.
See Section 17.5, "Invoking a WebLogic Web Service Using JMS Transport" for information about updating your client application to invoke the web service using JMS transport.

### 17.4.1 Updating the WSDL to Use JMS Transport

To update the WSDL to use JMS transport, you need to add the `<wsdl:binding>` definition that defines JMS transport information. You can add the definition in one of
the following ways, depending on whether you want to specify multiple transport options:

- Edit the existing HTTP `<wsdl:binding>` definition.
- To specify multiple transport options in the WSDL (such as HTTP and JMS transport), copy the existing HTTP `<wsdl:binding>` definition and edit it to use JMS transport.

Optionally, you can configure JMS transport properties at the binding or JMS URI level.

The following sections describe how to update the WSDL to use JMS transport:

- Section 17.4.1.1, "Enabling JMS Transport at the WSDL Binding Level"
- Section 17.4.1.2, "Configuring JMS Transport Properties in the WSDL"
- Section 17.4.1.3, "Example of Enabling JMS Transport in WSDL"

### 17.4.1.1 Enabling JMS Transport at the WSDL Binding Level

To enable JMS transport at the WSDL binding level, set the `transport` attribute of the `<soapwsdl:binding>` child element of the `<wsdl:binding>` element to `http://www.w3.org/2010/soapjms`.

Optionally, you can configure JMS transport properties within the `<wsdl:binding>` element definition, as described in Section 17.4.1.2, "Configuring JMS Transport Properties in the WSDL."

Example 17–4 provides an example of the `<wsdl:binding>` element for JMS transport. In this example, an HTTP binding is also defined.

**Example 17–4  Enabling JMS Transport at the WSDL Binding Level**

```xml
...<binding xmlns:soapjms="http://www.w3.org/2010/soapjms/"
    name="AddNumbersJMSBinding" type="tns:AddNumbersPortType">
    <soap:binding transport="http://www.w3.org/2010/soapjms/*" style="document" />
    <operation name="addNumbers">
        <soap:operation soapAction="" />
        <input>
            <soap:body use="literal" />
        </input>
        <output>
            <soap:body use="literal" />
        </output>
    </operation>
</binding>...
```

### 17.4.1.2 Configuring JMS Transport Properties in the WSDL

Optionally, you can configure a subset of JMS transport properties within the following WSDL elements:

- `<wsdl:binding>` element—Propagates to all ports using the binding.
- JMS URI, as described in Section 17.6.5, "Configuring the JMS URI."
Specifically, you can configure the following JMS transport properties in the WSDL. For a description of the properties, see Table 17–6, "Summary of JMS Transport Configuration Properties".

- deliveryMode
- jndiConnectionFactoryName
- jndiContextParameters
- jndiInitialContextFactory
- jndiURL
- priority
- replyToName
- timeToLive

Example 17–5 provides an example of the `<wsdl:binding>` element with JMS transport properties defined. In this case, the JMS transport properties propagate to all ports that use the binding.

**Example 17–5 Configuring JMS Transport Properties in the WSDL**

```xml
...<binding xmlns:soapjms="http://www.w3.org/2010/soapjms/
    name="AddNumbersBinding" type="tns:AddNumbersPortType">
    <soap:binding
        transport="http://www.w3.org/2010/soapjms/
            style='document' />
    <soapjms:jndiInitialContextFactory>
        weblogic.jndi.WLInitialContextFactory
    </soapjms:jndiInitialContextFactory>
    <soapjms:jndiConnectionFactoryName>
        weblogic.jms.XAConnectionFactory
    </soapjms:jndiConnectionFactoryName>
    <soapjms:bindingVersion>1.0</soapjms:bindingVersion>
    <soapjms:destinationName>
        com.oracle.webservices.api.jms.RequestQueue
    </soapjms:destinationName>
    <soapjms:targetService>AddNumbersService</soapjms:targetService>
    <soapjms:deliveryMode>
        com.oracle.webservices.api.jms.JMSDeliveryMode.PERSISTENT
    </soapjms:deliveryMode>
    <soapjms:priority>0</soapjms:priority>
    <soapjms:messageType>
        com.oracle.webservices.api.jms.JMSMessageType.BYTES
    </soapjms:messageType>
    <soapjms:destinationType>
        com.oracle.webservices.api.jms.jmsDestinationType.QUEUE
    </soapjms:destinationType>
    <operation name="addNumbers">
        <soap:operation soapAction="/" />
        <input>
            <soap:body use="literal" />
        </input>
        <output>
            <soap:body use="literal" />
        </output>
    </operation>
</binding>
...
17.4.1.3 Example of Enabling JMS Transport in WSDL

Example 17–6 provides an example of a WSDL that is configured for SOAP over JMS transport.

Example 17–6  Enabling JMS Transport in WSDL

```xml
<?xml version="1.0" encoding="UTF-8"?>
<definitions
    name="AddNumbers"
    targetNamespace="http://example.org"
    xmlns:tns="http://example.org"
    xmlns="http://schemas.xmlsoap.org/wsdl/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/">
  <types>
    <xsd:schema
        xmlns="http://www.w3.org/2001/XMLSchema"
        targetNamespace="http://example.org"
        elementFormDefault="qualified">
      <complexType name="addNumbersResponse">
        <sequence>
          <element name="return" type="xsd:int" />
        </sequence>
      </complexType>
    </xsd:schema>
  </types>
  <message name="addNumbers">
    <part name="parameters" element="tns:addNumbers" />
  </message>
  <message name="addNumbersResponse">
    <part name="result" element="tns:addNumbersResponse" />
  </message>
  <portType name="AddNumbersPortType">
    <operation name="addNumbers">
      <input message="tns:addNumbers" />
      <output message="tns:addNumbersResponse" />
    </operation>
  </portType>
  <binding xmlns:soapjms="http://www.w3.org/2010/soapjms/" name="AddNumbersBinding"
    type="tns:AddNumbersPortType">
    <soap:binding transport="http://www.w3.org/2010/soapjms/" style="document" />
    <soapjms:jndiInitialContextFactory>weblogic.jndi.WLInitialContextFactory</soapjms:jndiInitialContextFactory>
    <soapjms:jndiConnectionFactoryName>weblogic.jms.XAConnectionFactory</soapjms:jndiConnectionFactoryName>
    <soapjms:jndiConnectionFactoryName>weblogic.jms.XAConnectionFactory</soapjms:jndiConnectionFactoryName>
    <soapjms:bindingVersion>1.0</soapjms:bindingVersion>
  </binding>
</definitions>
```
17.5 Invoking a WebLogic Web Service Using JMS Transport

You write a client application to invoke a web service using JMS transport in the same way as you write one using the HTTP transport. In the case of JMS transport, the client sends SOAP request messages to the JMS request destination and receives SOAP response messages from the JMS response destination. For examples of invoking a web service, see Chapter 9, "Examples of Developing JAX-WS Web Service Clients."

You enable and optionally configure JMS transport on the web service client using one of the following methods:

- Use the `<jmstransportclient>` element of the `clientgen` Ant task to generate automatically client artifacts with JMS transport enabled, as described in Section 17.5.1, "Using the `<jmstransportclient>` Element in the Ant build.xml File."

- Update the web service client to configure JMS transport, using one of the following methods:

  - Adding `@com.oracle.webservices.api.jms.JMSTransportClient` annotation, as described in Section 17.5.2, "Using the `@JMSTransportClient` Annotation."
  
  - Adding `com.oracle.webservices.api.jms.JMSTransportClientFeature` feature client API, as described in Section 17.5.3, "Using the JMSTransportClientFeature Client API."
  
- Configure the JMS URI as the target endpoint address for synchronous clients, as described in Section 17.5.4, "Configuring the JMS URI as the Target Endpoint Address."
Update the asynchronous web service client to enable and configure JMS transport, as described in Section 17.5.5, “Using AsyncClientTransportFeature to Configure Asynchronous Clients.”

17.5.1 Using the <jmstransportclient> Element in the Ant build.xml File

The clientgen tool generates a JMS transport client proxy from a WSDL file containing a JMS transport binding. When generating the client proxy using clientgen, you can enable JMS transport by adding the <jmstransportclient> element in clientgen Ant task.

```xml
<target name="clientgen">
  <clientgen
    wsdl="./WarehouseService.wsdl"
    destDir="clientclasses"
    packageName="client.warehouse"
    type="JAXWS">
    <jmstransportclient
      targetService="JWSCEndpointService"
      destinationName="com.oracle.webservices.api.jms.RequestQueue"
      jndiInitialContextFactory="weblogic.jndi.WLInitialContextFactory"
      jndiConnectionFactoryName="weblogic.jms.ConnectionFactory"
      jndiURL="t3://localhost:7001"
      timeToLive=60000
      priority=1
      messageType=com.oracle.webservices.api.jms.JMSMessageType.TEXT
      replyToName="com.oracle.webservices.api.jms.ResponseQueue"
    />
  </clientgen>
</target>
```

Note: Although you cannot invoke a JMS-transport-configured web service using HTTP, you can view its WSDL using HTTP, which is how the clientgen Ant task is still able to create the JAX-WS artifacts for the web service.

Optionaly, you can configure the destination name, destination type, delivery mode, request and response queues, and other JMS transport properties, using the <jmstransportclient> element. For a complete list of JMS transport properties supported, see Section 17.6, “Configuring JMS Transport Properties.”

Example 17–7 shows an excerpt from a build.xml file that shows how to enable and configure JMS transport using the <jmstransportclient> element of the clientgen Ant task. The relevant code is shown in bold.

Example 17–7 Using the <jmstransportclient> Element in the Ant build.xml File

```xml
<target name="clientgen">
  <clientgen
    wsdl="./WarehouseService.wsdl"
    destDir="clientclasses"
    packageName="client.warehouse"
    type="JAXWS">
    <jmstransportclient
      targetService="JWSCEndpointService"
      destinationName="com.oracle.webservices.api.jms.RequestQueue"
      jndiInitialContextFactory="weblogic.jndi.WLInitialContextFactory"
      jndiConnectionFactoryName="weblogic.jms.ConnectionFactory"
      jndiURL="t3://localhost:7001"
      timeToLive=60000
      priority=1
      messageType=com.oracle.webservices.api.jms.JMSMessageType.TEXT
      replyToName="com.oracle.webservices.api.jms.ResponseQueue"
    />
  </clientgen>
</target>
```

For more information about using the clientgen Ant task, see “clientgen” in WebLogic Web Services Reference for Oracle WebLogic Server.

17.5.2 Using the @JMSTransportClient Annotation

When you run clientgen to generate the web service client artifacts from the WSDL file, the @com.oracle.webservices.api.jms.JMSTransportClient annotation is included automatically to the generated client proxy if JMS transport is enabled in the build file using the <jmstransportclient> element, as described in Section 17.5.1, “Using the <jmstransportclient> Element in the Ant build.xml File.”
If the `@JMSTransportClient` annotation is not configured automatically through clientgen, you can add it to the file manually.

 Optionally, you can configure the following JMS transport properties using the `@JMSTransportClient` annotation. For a description of the properties, see Table 17–6, "Summary of JMS Transport Configuration Properties".

- `destinationName`
- `destinationType`
- `enabled`
- `jmsMessageHeader`
- `jmsMessageProperty`
- `jndiConnectionFactoryName`
- `jndiContextParameters`
- `jndiInitialContextFactory`
- `jndiURL`
- `messageType`
- `priority`
- `replyToName`
- `targetService`
- `timeToLive`

Example 17–8 shows an excerpt from a client file that uses the `@JMSTransportClient` annotation, with the relevant code in bold.

**Example 17–8  Enabling JMS Transport for a Client Proxy Using the `@JMSTransportClient` Annotation**

```java
import javax.xml.ws.WebServiceClient;
import com.oracle.webservices.api.jms.JMSTransportClient;
...
@WebServiceClient(name = "WarehouseService", targetNamespace = "http://oracle.com/samples/",
wsdlLocation="WarehouseService.wsdl")
@JMSTransportClient (destinationName="myQueue",
replyToName="myReplyToQueue",
jndiURL="t3://localhost:7001",
jndiInitialContextFactory="weblogic.jndi.WLInitialContextFactory",
jndiConnectionFactoryName="weblogic.jms.ConnectionFactory",
timeToLive=1000, priority=1,
messageType=com.oracle.webservices.api.jms.JMSTransportClientFeature
)
public class WarehouseService extends Service { ... }
```

17.5.3 Using the JMSTransportClientFeature Client API

You can use the `com.oracle.webservices.api.jms.JMSTransportClientFeature` client API to configure JMS transport in the web service client.

Optionally, you can configure the following JMS transport properties using the `com.oracle.webservices.api.jms.JMSTransportClientFeature`. For a description of
the properties, see Table 17–6, “Summary of JMS Transport Configuration Properties”.

- destinationName
- destinationType
- enabled
- jmsMessageHeader
- jmsMessageProperty
- jndiConnectionFactoryName
- jndiContextParameters
- jndiInitialContextFactory
- jndiURL
- messageType
- priority
- replyToName
- targetService
- timeToLive

Example 17–9 shows an excerpt from a Web client that uses JMSTransportClientFeature, with the relevant code in bold.

**Example 17–9  Enabling JMS Transport for a Client Proxy Using JMSTransportClientFeature**

... import javax.xml.namespace.QName; import java.net.URL; import com.oracle.webservices.api.jms.JMSTransportClientFeature; ...
URL url = new URL("http://localhost:7001/WarehouseServicePort/WarehouseService?WSDL"); QName serviceName = new QName("http://www.oracle.com/samples/", "WarehouseService"); WarehouseService service = new WarehouseService(url, serviceName); JMSTransportClientFeature feature = JMSTransportClientFeature.builder().jndiInitialContextFactory("weblogic.jndi.WLInitialContextFactory").jndiURL("t3://localhost:7001").build(); port = service.getWarehouseShipmentsPort(new WebServiceFeature[]{feature}); Item item = new Item(); item.setProductNumber(10001); item.setQuantity(100); port.shipGoods(item, "BEA"); ...

Example 17–10 shows an excerpt from a Dispatch client that uses JMSTransportClientFeature, with the relevant code in bold.

**Example 17–10  Enabling JMS Transport for a Dispatch Client Using JMSTransportClientFeature**

... import javax.xml.namespace.QName; import java.net.URL; import javax.xml.bind.JAXBContext; import javax.xml.ws.ServiceMode; import javax.xml.ws.Dispatch; import com.oracle.webservices.api.jms.JMSTransportClientFeature; ...

Service service = Service.create(new URL(wsdl), new QName(nameSpace, serviceName));
JAXBContext jaxbContext = JAXBContext.newInstance(ObjectFactory.class);
JMSTransportClientFeature feature = JMSTransportClientFeature.builder().jndiURL("t3://adc2170585:7003").build();
Dispatch dispatch =
    service.createDispatch(new QName(nameSpace, "WarehouseServicePort"), jaxbContext,
    Service.Mode.PAYLOAD, new WebServiceFeature[]{feature});
...

17.5.4 Configuring the JMS URI as the Target Endpoint Address

You can specify the JMS URI as the target endpoint address for the client binding to enable and configure JMS transport in the web service client. For information about constructing the JMS URI, see Section 17.6.5, "Configuring the JMS URI."

Example 17–11 shows an excerpt from a Web client that sets the target endpoint address to the JMS URI with the relevant code in bold. In this example, if the replyToName had been configured using JMSTransportClientFeature, it would take precedence over the target endpoint address value.

Example 17–11 Enabling JMS Transport for a Client Proxy Using JMS URI

...  
import javax.xml.namespace.QName;
import java.net.URL;
import javax.xml.ws.BindingProvider;
import javax.xml.ws.handler.MessageContext;
import com.oracle.webservices.api.jms.JMSTransportClientFeature;
...
URL url = new URL("http://localhost:7001/WarehouseServicePort/WarehouseService?WSDL");
QName serviceName = new QName("http://www.oracle.com/samples/", "WarehouseService");
WarehouseService service = new WarehouseService(url, serviceName);
JMSTransportClientFeature feature = new JMSTransportClientFeature().build();
feature.setJndiInitialContextFactory("weblogic.jndi.WLInitialContextFactory");
feature.setJndiUrl("t3://localhost:7001");
port = service.getWarehouseShipmentsPort(new WebServiceFeature[]{feature});
BindingProvider bp = (BindingProvider) port;
bp.getRequestContext().put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
    "jms:jndi:myQueue?targetService=WarehouseService&replyToName=myReplyToQueue");
Item item = new Item();
item.setProductNumber(10001);
item.setQuantity(100);
port.shipGoods(item, "BEA");
...

Example 17–12 shows an excerpt from a Dispatch client that uses JMSTransportClientFeature, with the relevant code in bold. In this example, the JMS transport properties specified in the JMSTransportClientFeature take precedence over the JMS URI.

Example 17–12 Example of Enabling JMS Transport for a Dispatch Client Using JMS URI

...
String uri =
;
Service service = Service.create(new URL(wsdl), new QName(nameSpace, serviceName));
JAXBContext jaxbContext = JAXBContext.newInstance(ObjectFactory.class);
Invoking a WebLogic Web Service Using JMS Transport

JMSTransportClientFeature feature = new JMSTransportClientFeature().build();
feature.setJndiUrl("t3://adc2170585:7003");

Dispatch dispatch =
    service.createDispatch(new QName(nameSpace, "WarehouseServicePort"), jaxbContext,
        Service.Mode.PAYLOAD, new WebServiceFeature[]{feature});

dispatch.getRequestContext().put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY, uri );
...

17.5.5 Using AsyncClientTransportFeature to Configure Asynchronous Clients

The asynchronous client transport feature, described in Section 12.5, "Developing Scalable Asynchronous JAX-WS Clients (Asynchronous Client Transport)," provides a scalable asynchronous client programming model.

To enable SOAP over JMS transport for an asynchronous client:

1. Specify the JMS URI as the target endpoint address for the client binding. For information about constructing the JMS URI, see Section 17.6.5, "Configuring the JMS URI."

   **Note:** When using JMS transport, the context path of the asynchronous response endpoint is ignored if specified using AsyncClientTransportFeature.

2. Optionally, configure a "permanent" response queue by configuring the address or ReplyTo header using the AsyncClientTransportFeature, as described in Section 12.5.1, "Enabling and Configuring the Asynchronous Client Transport Feature."

   If you do not configure the address of the JMS response queue or if the destinationName property is set to anonymous (which is not supported by JMS transport), then a temporary response queue is used. For more information about configuring the JMS response queue, see Section 17.6.8, "Configuring the JMS Response Queue."

When the endpoint is invoked, the client runtime environment publishes the response endpoint and deploys the JMS listener on the response JMS queue. Once attached to the client, the AsyncClientTransportFeature instance determines the response endpoint of all client invocations; the replyToName property in the target endpoint address and JMSTransportClientFeature are ignored.

Example 17–13 shows an excerpt from an asynchronous client that uses AsyncClientTransportFeature, with the relevant code in **bold**. In this example, the replyTo and faultTo addresses are defined and passed to the client.

**Example 17–13  Example of Enabling JMS Transport and Configuring Permanent Queue for an Asynchronous Client**

... WarehouseService service = new WarehouseService(url, serviceName);
AsyncClientTransportFeature replyTo = new AsyncClientTransportFeature (  
    ".jms:jndi:myReplyToQueue?targetService=WarehouseService");
AsyncClientTransportFeature faultTo = new AsyncClientTransportFeature (  
    ".jms:jndi:myFaultToQueue?targetService=WarehouseService");
AsyncClientTransportFeature callbackFeature =  new AsyncClientTransportFeature (  
    "jdbc:oracle:thin:@abc2170585:1521/myAppDB");
replyTo.getEndpointReference(W3CEndpointReference.class),
faultTo.getEndpointReference(W3CEndpointReference.class));
port = service.getWarehouseServicePort(new WebServiceFeature[]{ callbackFeature });
status = port.shipGoods(item, "BEAN");
(BindingProvider) port.getRequestContext().put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
  "jms:jndi:myQueue?targetService=WarehouseService");
((Closable)port).close();
...

17.6 Configuring JMS Transport Properties

Optionally, you can configure JMS transport properties when enabling JMS transport, as described in the following sections:

- Section 17.6.1, "Summary of JMS Transport Configuration Properties"
- Section 17.6.2, "Configuration Methods and Order of Precedence"
- Section 17.6.3, "Configuring JMS Transport Using the Administration Console"
- Section 17.6.4, "Configuring JMS Transport Using WLST"
- Section 17.6.5, "Configuring the JMS URI"
- Section 17.6.6, "Configuring the JMS Request URI"
- Section 17.6.7, "Configuring the WS-Addressing Headers"
- Section 17.6.8, "Configuring the JMS Response Queue"
- Section 17.6.9, "Configuring the JMS Message Type"
- Section 17.6.10, "Configuring HTTP Access to the WSDL File"

17.6.1 Summary of JMS Transport Configuration Properties

Table 17–6 lists the JMS transport properties that can be configured and the supported configuration methods, defined in Table 17–7.
### Table 17-6  Summary of JMS Transport Configuration Properties

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Supported Configuration Methods</th>
</tr>
</thead>
</table>
| activationConfig  | Activation configuration properties passed to the JMS provider. Each property is specified as name-value pairs using the following format: "name1=value1;...;nameN=valueN" For example: "key1=value1;key2=value2" For a list of activation configuration properties that are supported by this property, see Table 17-7. This value defaults to: "" | ■ <jmstransportservice> child element in the <jws> element of the jwsc Ant task  
■ @JMSTransportService annotation |
| bindingVersion    | Version of the SOAP JMS binding. This value must be set to 1.0 for this release, which equates to com.oracle.webservices.api.jms.JMSBindingVersion.SOAP.jms_1_0.  
This value maps to the SOAPJMS_bindingVersion JMS message property, as defined in Table 17-1. | ■ <jmstransportservice> child element in the <jws> element of the jwsc Ant task  
■ @JMSTransportService annotation |
| deliveryMode      | Delivery mode indicating whether the request message is persistent. Valid values are 
com.oracle.webservices.api.jms.JMSDeliveryMode.PERSISTENT and 
com.oracle.webservices.api.jms.JMSDeliveryMode.NON_PERSISTENT.  
This value defaults to: 
com.oracle.webservices.api.jms.JMSDeliveryMode.PERSISTENT | ■ <jmstransportservice> child element in the <jws> element of the jwsc Ant task  
■ @JMSTransportService annotation |
| destinationName   | JNDI name of the destination queue or topic.  
This value defaults to: "com.oracle.webservices.api.jms.RequestQueue" | All configuration methods in Table 17-8 |
| destinationType   | Destination type. Valid values include: 
com.oracle.webservices.api.jms.JMSType.QUEUE or 
com.oracle.webservices.api.jms.JMSType.TOPIC.  
This value defaults to: 
com.oracle.webservices.api.jms.JMSType.QUEUE  
This value overrides the destinationType value specified as an entry in activationConfig property (as defined in Table 17-7), if applicable.  
Topics are supported only for one-way communication. | All configuration methods in Table 17-8 |
| enabled           | Boolean flag that specifies whether JMS transport is enabled. This value defaults to true. | @JMSTransportService and @JMSTransportClient annotations |
### Table 17–6 (Cont.) Summary of JMS Transport Configuration Properties

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Supported Configuration Methods</th>
</tr>
</thead>
</table>
| enableHttpWsdlAccess          | Boolean flag that specifies whether to publish the WSDL through HTTP. This flag defaults to true. | - `<jmstransportservice>` child element in the `<jws>` element of the `jwsc` Ant task  
- `@JMSTransportService` annotation                                                                 |
| jmsMessageHeader              | JMS header properties. Each property is specified as name-value pairs using the following format:  
  "name1=value1&...&nameN=valueN"  
  For example:  
  "JMSType=car&JMSPriority=4"  
  This value defaults to: "" | - `<jmstransportservice>` child element in the `<jws>` element of the `jwsc` Ant task  
- `@JMSTransportService` annotation  
- `@JMSTransportClient` annotation                                                                 |
| jmsMessageProperty            | JMS message properties. Each property is specified as name-value pairs using the following format:  
  "name1=value1&...&nameN=valueN"  
  For example:  
  "JMSType=car&JMSPriority=4"  
  This value defaults to: "" | - `<jmstransportservice>` child element in the `<jws>` element of the `jwsc` Ant task  
- `@JMSTransportService` annotation  
- `@JMSTransportClient` annotation                                                                 |
| jndiConnectionFactoryName     | JNDI name of the connection factory that is used to establish a JMS connection.  
This value defaults to:  
"com.oracle.webservices.api.jms.ConnectionFactory" | All configuration methods in Table 17–8                                                                                                                            |
| jndiContextParameter          | JNDI properties. Each property is specified as name-value pairs using the following format:  
  "name1=value1&...&nameN=valueN"  
  The properties are added to the  
  `java.util.Hashtable` sent to the  
  `InitialContext` constructor for the JNDI provider.  
This value defaults to: "" | All configuration methods in Table 17–8                                                                                                                            |
| jndiInitialContextFactory     | Name of the initial context factory class used for JNDI lookup. This value maps to  
the `java.naming.factory.initial` property.  
This value defaults to:  
"weblogic.jndi.WLInitialContextFactory" | All configuration methods in Table 17–8                                                                                                                            |
| jndiURL                       | JNDI provider URL.  
This value defaults to:  
"t3://localhost:7001"  
This value maps to the  
`java.naming.provider.url` property. | All configuration methods in Table 17–8                                                                                                                            |
| lookupVariant                 | Method used for looking up the specified destination name. This value must be set to  
`jndi` to support JMS transport; this is the default. | None (cannot be modified)                                                                                                                                              |
Configuring JMS Transport Properties

Table 17–6 (Cont.) Summary of JMS Transport Configuration Properties

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Supported Configuration Methods</th>
</tr>
</thead>
</table>
| mdbPerDestination | Boolean flag that specifies whether to create one listening message-driven bean (MDB) for each requested destination. This value defaults to true. If set to false, one listening MDB is created for each web service port, and that MDB cannot be shared by other ports. | - `<jmstransportservice>` child element in the `<jws>` element of the `jwsc` Ant task  
- `@JMSTransportService` annotation |
| messageType       | Message type to use with the request message. Valid values are com.oracle.webservices.api.jms.JMSMessageType.BYTES and com.oracle.webservices.api.jms.JMSMessageType.TEXT. This value defaults to: com.oracle.webservices.api.jms.JMSMessageType.BYTES. For more information about configuring the message type, see Section 17.6.9, "Configuring the JMS Message Type." | All configuration methods in Table 17–8 |
| priority          | JMS priority associated with the request and response message. Specify this value as a positive Integer from 0, the lowest priority, to 9, the highest priority. The default value is 0. | All configuration methods in Table 17–8 |
| replyToName       | JNDI name of the JMS destination to which the response message is sent. For a two-way operation, a temporary response queue is generated by default. Using the default temporary response queue minimizes the configuration that is required. However, in the event of a server failure, the response message may be lost. This property enables the client to use a previously defined, "permanent" queue or topic rather than use the default temporary queue or topic, for receiving replies. For more information about configuring the JMS response queue, see Section 17.6.8, "Configuring the JMS Response Queue." The value maps to the JMSReplyTo JMS header in the request message. This value defaults to: "" | All configuration methods in Table 17–8 |
| runAsPrincipal    | Principal used to run the listening MDB. This value defaults to: "" | - `<jmstransportservice>` child element in the `<jws>` element of the `jwsc` Ant task  
- `@JMSTransportService` annotation |
Configuring JMS Transport Properties

The following table lists the activation properties that are supported by the activationConfig property in Table 17–6. For information about using the activation properties to tune MDBs, see "Tuning Message-Driven Beans" in Tuning Performance of Oracle WebLogic Server.

**Table 17–6 (Cont.) Summary of JMS Transport Configuration Properties**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Supported Configuration Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>runAsRole</td>
<td>Role used to run the listening MDB. This value defaults to: &quot;&quot;</td>
<td>• &lt;jmstransportservice&gt; child element in the &lt;jws&gt; element of the jwsc Ant task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• @JMSTransportService annotation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &lt;jmstransportservice&gt; child element in the &lt;jws&gt; element of the jwsc Ant task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• @JMSTransportService annotation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• @JMSTransportClient annotation</td>
</tr>
<tr>
<td>targetService</td>
<td>Port component name of the web service. This value is used by the service</td>
<td>• &lt;jmstransportservice&gt; child element in the &lt;jws&gt; element of the jwsc Ant task</td>
</tr>
<tr>
<td></td>
<td>implementation to dispatch the service request. If not specified, the service</td>
<td>• @JMSTransportService annotation</td>
</tr>
<tr>
<td></td>
<td>name from the WSDL or @javax.jws.WebService annotation is used.</td>
<td>• @JMSTransportClient annotation</td>
</tr>
<tr>
<td></td>
<td>This value maps to the SOAPJMS_targetService JMS message property.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This value defaults to: &quot;&quot;</td>
<td></td>
</tr>
<tr>
<td>timeToLive</td>
<td>Lifetime, in milliseconds, of the request message. A value of 0 indicates</td>
<td>All configuration methods in Table 17–8</td>
</tr>
<tr>
<td></td>
<td>an infinite lifetime. If not specified, the JMS-defined default value of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1800000L is used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On the service side, timeToLive also specifies the expiration time for each</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDB transaction.</td>
<td></td>
</tr>
</tbody>
</table>

The following table lists the activation properties that are supported by the activationConfig property in Table 17–6. For information about using the activation properties to tune MDBs, see "Tuning Message-Driven Beans" in Tuning Performance of Oracle WebLogic Server.

**Table 17–7 Activation Properties Supported by the activationConfig Property**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acknowledgeMode</td>
<td>Acknowledgment mode that controls how the JMS provider is notified that the</td>
</tr>
<tr>
<td></td>
<td>message was received and processed. Valid values include:</td>
</tr>
<tr>
<td></td>
<td>• AUTO_ACKNOWLEDGE—Message is acknowledged immediately. This is the default.</td>
</tr>
<tr>
<td></td>
<td>• DUPS_OK_ACKNOWLEDGE—Acknowledgement may be delayed, allowing duplicate</td>
</tr>
<tr>
<td></td>
<td>messages to be received.</td>
</tr>
<tr>
<td></td>
<td>The acknowledgement mode is ignored if you are using container-managed</td>
</tr>
<tr>
<td></td>
<td>transactions. (In this case, the acknowledgement is performed within the</td>
</tr>
<tr>
<td></td>
<td>context of the transaction.)</td>
</tr>
<tr>
<td>connectionFactoryJndiName</td>
<td>JNDI name of the JMS connection factory that the MDB uses to create its</td>
</tr>
<tr>
<td></td>
<td>queues and topics. This value defaults to weblogic.jms.MessageDrivenBean</td>
</tr>
<tr>
<td></td>
<td>ConnectionFactory.</td>
</tr>
<tr>
<td>destinationJndiName</td>
<td>JNDI name used to associate an MDB with an actual JMS queue or topic deployed</td>
</tr>
<tr>
<td></td>
<td>in the WebLogic Server JNDI tree.</td>
</tr>
<tr>
<td>destinationType</td>
<td>Type of the JMS destination. Valid values include: QUEUE and TOPIC.</td>
</tr>
<tr>
<td>dispatchPolicy</td>
<td>Work manager for the MDB. This value defaults to</td>
</tr>
<tr>
<td></td>
<td>weblogic.wsee.jaxws.mdb.DispatchPolicy.</td>
</tr>
<tr>
<td>distributedDestinationConnection</td>
<td>Connection setting that specifies whether an MDB that accesses a WebLogic JMS</td>
</tr>
<tr>
<td></td>
<td>distributed destination (topic or queue) in the same cluster consumes from</td>
</tr>
<tr>
<td></td>
<td>all distributed destination members or only those members local to the current</td>
</tr>
<tr>
<td></td>
<td>WebLogic Server instance. This value includes:</td>
</tr>
<tr>
<td></td>
<td>• LocalOnly—MDB consumes JMS distributed destinations from members local to</td>
</tr>
<tr>
<td></td>
<td>the current WebLogic Server instance. This is the default.</td>
</tr>
<tr>
<td></td>
<td>• EveryMember—MDB consumes JMS distributed destinations from all distributed</td>
</tr>
<tr>
<td></td>
<td>destination members.</td>
</tr>
</tbody>
</table>

Using SOAP Over JMS Transport  17-23
Optionally, you can configure JMS transport properties when enabling JMS transport using one of the methods defined in Table 17–8.

### Table 17–7 (Cont.) Activation Properties Supported by the activationConfig Property

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>durableSubscription Deletion</td>
<td>Flag that specifies whether you want durable topic subscriptions to be automatically deleted when an MDB is undeployed or removed. This value defaults to false.</td>
</tr>
<tr>
<td>initialContextFactory</td>
<td>Initial context factory that the EJB container uses to create its connection factories. This value defaults to weblogic.jndi.WLInitialContextFactory.</td>
</tr>
<tr>
<td>initSuspendSeconds</td>
<td>Initial number of seconds to suspend an MDB's JMS connection when the EJB container detects a JMS resource outage. This value can be set to any Integer value and defaults to 5.</td>
</tr>
<tr>
<td>jmsClientId</td>
<td>Client ID for the MDB when it connects to a JMS destination. This value is used for durable subscriptions to JMS topics.</td>
</tr>
<tr>
<td>jmsPollingIntervalSeconds</td>
<td>Number of seconds between attempts by the EJB container to reconnect to a JMS destination that has become unavailable. This value can be set to any Integer value and defaults to 10.</td>
</tr>
<tr>
<td>maxBeansInFreePool</td>
<td>Maximum number of inactive MDBs in the free pool. This value can be set to any positive Integer value or 0. This value defaults to 1000.</td>
</tr>
<tr>
<td>maxMessagesInTransaction</td>
<td>Maximum number of messages that can be in a transaction for this MDB. This value can be set to any positive Integer value or 0. This value defaults to 1.</td>
</tr>
<tr>
<td>maxSuspendSeconds</td>
<td>Maximum number of seconds to suspend an MDB's JMS connection when the EJB container detects a JMS resource outage. This value can be set to any Integer and defaults to 60.</td>
</tr>
<tr>
<td>messageSelector</td>
<td>String used by a client to specify, by header field references and property references, the messages it should receive. Only messages whose header and property values match the specified selector are delivered. This value can be set to a message header or a conditional expression using message properties. This value defaults to null.</td>
</tr>
<tr>
<td>providerURL</td>
<td>URL provider to be used by the InitialContext, typically, host:port. This value can be any valid URL and defaults to null.</td>
</tr>
<tr>
<td>subscriptionDurability</td>
<td>Flag that specifies whether a JMS topic subscription is Durable or NonDurable. This value defaults to Durable.</td>
</tr>
<tr>
<td>topicMessagesDistributionMode</td>
<td>Distribution mode for topic messages. Valid values include: One-Copy-Per-Application, One-Copy-Per-Server, Compatibility. This value defaults to Compatibility. For more information about the valid values, see &quot;Topic Deployment Scenarios&quot; in Developing Message-Driven Beans for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>transAttribute</td>
<td>Transaction setting that specifies how the container must manage the transaction boundaries when delegating a method invocation to an enterprise bean's business method. Valid values include: Required, NotSupported, Supports, RequiresNew, Mandatory, and Never. This value defaults to Required. For more information about the valid values, see Section 15, &quot;Using Web Services Atomic Transactions.&quot;</td>
</tr>
<tr>
<td>transTimeoutSeconds</td>
<td>Maximum duration for an EJB's container-initiated transactions, in seconds, after which the transaction is rolled back and the service will return a SOAP fault. This value can be set to any positive Integer or 0. If the transaction timeout is not specified or is set to 0, the transaction timeout configured for the domain is used. If a timeout is not configured for the domain, the default is 30.</td>
</tr>
<tr>
<td>use81StylePolling</td>
<td>Flag that specifies whether backwards compatibility for WebLogic Server version 8.1-style polling is supported. Valid values include: True or False. This value defaults to False.</td>
</tr>
</tbody>
</table>

### 17.6.2 Configuration Methods and Order of Precedence

Optionally, you can configure JMS transport properties when enabling JMS transport using one of the methods defined in Table 17–8.
The following summarizes the order of precedence for JMS transport property configuration on the web service or client at design time and run time:

- For the web service at **design time** (from high to low):
  - `<jmstransportservice>` child element in the `<jws>` element of the jwsc Ant task
  - `@JMSTransportService` annotation

- For the web service at **run time** (from high to low):
  - Administration Console
  - `<soapjms-service-endpoint-address>` element in the `weblogic-webservices.xml` deployment descriptor
  - `@JMSTransportService` annotation
For the client at **design time** (from high to low):
- `<jmstransportclient>` child element of clientgen
- JMS transport properties defined in the WSDL

For the client at **run time** (from high to low):
- JMS URI service endpoint address
- `JMSTransportClientFeature` API
- `@JMSTransportClient` annotation

### 17.6.3 Configuring JMS Transport Using the Administration Console

After you have deployed your web service with JMS transport enabled, you can configure JMS transport properties using the WebLogic Server Administration Console.

To configure JMS transport properties using the WebLogic Server Administration Console:

1. Invoke the WebLogic Server Administration Console, as described in "Invoking the Administration Console" in *Understanding WebLogic Web Services for Oracle WebLogic Server*.
2. In the left navigation pane, select **Deployments**.
3. Click the name of the web service in the Deployments table.
4. Select the **Configuration** tab, then the **Port Components** tab.
5. Click the name of the web service endpoint in the Ports table.
6. Select the **SOAP over JMS Transport** tab.
7. Click **Customize SOAP over JMS Transport Configuration** and follow the instructions to save the deployment plan, if required.
8. Edit the SOAP over JMS transport properties, as described in Section 17.6, "Configuring JMS Transport Properties."
9. Click **Save**.

For more information, see "Configuring SOAP Over JMS Transport" in the *Oracle WebLogic Server Administration Console Online Help*.

### 17.6.4 Configuring JMS Transport Using WLST

Alternatively, you can use WLST to configure JMS transport. For information about using WLST to extend the domain, see "Configuring Existing Domains" in *Understanding the WebLogic Scripting Tool*.

### 17.6.5 Configuring the JMS URI

When a WebLogic web service is configured to use SOAP over JMS as the connection transport, the endpoint address specified for the corresponding port in the generated WSDL of the web service uses `jms:` in its URL rather than `http://`

The JMS URI format is shown below:

```
jms:lookupVariant:destinationName[?targetService=value[&property=value][&property=value]...]
```
The JMS URI is constructed as follows:

- Prefix `jms`:
- Lookup variant type (must be set to `jndi`)
- JMS destination name (`destinationName`)
- Query string containing a list of property-value pairs used to specify JMS endpoint information. The `targetService` property must be specified to define the port component name of the web service.

Other valid properties include:
- `bindingVersion`
- `deliveryMode`
- `deliveryType`
- `jndiConnectionFactoryName`
- `jndiContextParameter`
- `jndiInitialContextFactory`
- `jndiURL`
- `messageType`
- `priority`
- `replyToName`
- `timeToLive`

The `lookupVariant`, `destinationName`, and `targetService` JMS properties are required in the JMS endpoint address.

For more information about the JMS transport properties that construct the JMS URI, see Table 17–6. Optionally, you can configure JMS transport properties when enabling JMS transport using one of the methods defined in Table 17–7.

**Examples:**
The following provides an example of a JMS endpoint address. In this example, the JMS destination is `myQueue` and the port component name of the web service is `WarehouseServicePort`.

```
jms:jndi:myQueue?targetService=WarehouseServicePort
```

The following example shows the same JMS endpoint address with `replyToName` property set to specify the JNDI name of the JMS destination to which the response message is sent.

```
jms:jndi:myQueue?targetService=WarehouseServicePort&replyToName=myReplyToQueue
```

The following example shows how to specify additional JNDI environment properties, such as `jndi-com.acme.jndi.enable.tracing` and `jndi-java.naming.referral`.

```
jms:jndi:myQueue?targetService=WarehouseServicePort&jndi-com.acme.jndi.enable.tracing=true&jndi-java.naming.referral=ignore
```
17.6.6 Configuring the JMS Request URI

Each JMS transport message has a message property defined as SOAP\_JMS\_requestURI that is derived from the JMS URI. The JMS Request URI is constructed using the JMS URI and stripping off the query parameters.

The JMS request URI format is shown below:

```
jms:lookupVariant:destinationName
```

The JMS Request URI is constructed as follows:

- Prefix `jms`:
- Lookup variant type (must be set to `jndi`)
- JMS destination name (`destinationName`)

For more information about the JMS transport properties that construct the JMS Request URI, see Table 17–6. Optionally, you can configure JMS transport properties when enabling JMS transport using one of the methods defined in Table 17–7.

**Example:**
The following provides an example of a JMS endpoint address. In this example, the JMS destination is `myQueue`.

```
jms:jndi:myQueue
```

17.6.7 Configuring the WS-Addressing Headers

Web services and clients that use SOAP over JMS transport populate the WS-Addressing headers `To` and `ReplyTo` of the request and response messages with a value that is derived from the JMS URI.

The WS-Addressing header format is shown below:

```
jms:lookupVariant:destinationName?targetService=value
```

For more information about the JMS transport properties that construct the WS-Addressing headers, see Table 17–6. Optionally, you can configure JMS transport properties when enabling JMS transport using one of the methods defined in Table 17–7.

**Examples:**
The following provides an example of the WS-Addressing headers in a SOAP request message.

```xml
<S:Header>
    <To xmlns="http://www.w3.org/2005/08/addressing">
        jms:jndi:myQueue?targetService=WarehouseService
    </To>
    <Action xmlns="http://www.w3.org/2005/08/addressing">
        http://www.oracle.com/samples/ShipGoodsRequest
    </Action>
    <ReplyTo xmlns="http://www.w3.org/2005/08/addressing">
        <Address>jms:jndi:myReplyToQueue?targetService=WarehouseService</Address>
    </ReplyTo>
    <MessageID xmlns="http://www.w3.org/2005/08/addressing">
        uuid:3b9e7b20-3aa0-4a4a-9422-470fa7b9ada1
    </MessageID>
</S:Header>
```
The following provides an example of the WS-Addressing headers in a SOAP response message.

```
<S:Header>
  <To xmlns="http://www.w3.org/2005/08/addressing">
    jms:jndi:myReplyToQueue?targetService=WarehouseService
  </To>
  <Action xmlns="http://www.w3.org/2005/08/addressing">
    http://www.oracle.com/samples/ShipGoodsResponse
  </Action>
  <MessageID xmlns="http://www.w3.org/2005/08/addressing">
    uuid:9d0be951-79fc-4a56-b3e6-4775bde2bd82
  </MessageID>
  <RelatesTo xmlns="http://www.w3.org/2005/08/addressing">
    uuid:3b9e7b20-3aa0-4a4a-9422-470fa7b9ad1
  </RelatesTo>
</S:Header>
```

### 17.6.8 Configuring the JMS Response Queue

For a two-way operation, a temporary response queue is generated by default. Using the default temporary response queue minimizes the configuration that is required. However, in the event of a server failure, the response message may be lost.

You can configure a "permanent" JMS response queue—one that is available after server restart. A permanent JMS response queue provides the following benefits:

- Ensures that the response message can be restored following a server restart.
- Improves performance, avoiding the overhead required to create the temporary queue at initial invocation.
- Enables you to configure the queue for quality of service (QoS).

You can configure the JMS response queue using one of the following methods (in order of precedence):

- Configuring the address or ReplyTo header using the AsyncClientTransportFeature, as described in Section 12.5.1, "Enabling and Configuring the Asynchronous Client Transport Feature."

- Configuring the replyToName property using one of the following methods:
  - `<jmstransportclient>` element of clientgen, as described in Section 17.5.1, "Using the `<jmstransportclient>` Element in the Ant build.xml File."
  - Target endpoint address, as described in Section 17.5.4, "Configuring the JMS URI as the Target Endpoint Address."
  - JMSTransportClientFeature, as described in Section 17.5.3, "Using the JMSTransportClientFeature Client API."
  - `@JMSTransportClient` annotation, as described in Section 17.5.2, "Using the `@JMSTransportClient` Annotation."

**Note:** If the destinationName property is set to anonymous (which is not supported by JMS transport), then a temporary response queue is used.
By default, the JMS response queue is used as the fault queue for JMS transport service invocation. You can configure the faultTo header using the AsyncClientTransportFeature, as described in Section 12.5.1.2, "Configuring the ReplyTo and FaultTo Headers of the Asynchronous Response Endpoint."

### 17.6.9 Configuring the JMS Message Type

You can configure one of the following message types to use with the request message.

- **com.oracle.webservices.api.jms.JMSMessageType.BYTES**—The body of the JMS message is binary data. This is the default.
- **com.oracle.webservices.api.jms.JMSMessageType.TEXT**—The body of the JMS message is String data.

You can configure the messageType property using any of the configuration methods defined in Table 17–8.

The web service uses the same message type when sending the response. If the request is received as a BYTES, the reply will be sent as a BYTES.

When setting the messageType property to TEXT, consider the following:

- For large payloads, the memory requirements for TEXT messages can be significantly greater than BYTES messages because the data requirements for the in-memory representation is larger.
- Messages with binary attachments must be base64-encoded, which can also increase the size of the message significantly.

### 17.6.10 Configuring HTTP Access to the WSDL File

By default, the WSDL of the deployed web service is still accessible using HTTP. If you want to disable access to the WSDL file, in particular if your web service can be accessed outside of a firewall, then you can do one of the following:

- Use the enableHttpWsdlAccess attribute of the <jmstransportservice> child element of the <jws> element, as described in Section 17.3.2, "Using the <jmstransportservice> Child Element in the Ant build.xml File."
- @JMSTransportService annotation, as described in Section 17.3.1, "Using the @JMSTransportService Annotation."
- Use the WebLogic Server Administration Console to disable access to the WSDL file after the web service has been deployed. In this case, the configuration information will be stored in the deployment plan rather than through the annotation.

To use the WebLogic Server Administration Console to perform this task, go to the Configuration -> General page of the deployed web service and uncheck the View Dynamic WSDL Enabled check box. After saving the configuration to the deployment plan, you must redeploy (update) the web service, or Enterprise Application which contains it, for the change to take effect.

### 17.7 Monitoring SOAP Over JMS Transport

You can monitor web services that use SOAP over JMS transport from the following perspectives:

- Monitor web service performance, as described in:
- "Monitor a Web Service" in Oracle WebLogic Server Administration Console Online Help
- "Monitoring and Auditing Web Services" in Administering Web Services
- Monitor JMS destination metrics, as described in "Monitoring JMS Statistics and Managing Messages" in Administering JMS Resources for Oracle WebLogic Server.
This chapter describes how to create and use SOAP message handlers for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 18.1, "Overview of SOAP Message Handlers"
- Section 18.2, "Adding Server-side SOAP Message Handlers: Main Steps"
- Section 18.3, "Adding Client-side SOAP Message Handlers: Main Steps"
- Section 18.4, "Designing the SOAP Message Handlers and Handler Chains"
- Section 18.5, "Creating the SOAP Message Handler"
- Section 18.6, "Configuring Handler Chains in the JWS File"
- Section 18.7, "Creating the Handler Chain Configuration File"
- Section 18.8, "Compiling and Rebuilding the Web Service"
- Section 18.9, "Configuring the Client-side SOAP Message Handlers"

### 18.1 Overview of SOAP Message Handlers

Web services and their clients may need to access the SOAP message for additional processing of the message request or response. A SOAP message handler provides a mechanism for intercepting the SOAP message in both the request and response of the web service. You can create SOAP message handlers to enable web services and clients to perform additional processing on the SOAP message.

A simple example of using handlers is to access information in the header part of the SOAP message. You can use the SOAP header to store web service specific information and then use handlers to manipulate it.

You can also use SOAP message handlers to improve the performance of your web service. After your web service has been deployed for a while, you might discover that many consumers invoke it with the same parameters. You could improve the performance of your web service by caching the results of popular invokes of the web service (assuming the results are static) and immediately returning these results when appropriate, without ever invoking the back-end components that implement the web service. You implement this performance improvement by using handlers to check the request SOAP message to see if it contains the popular parameters.

JAX-WS supports two types of SOAP message handlers: SOAP handlers and logical handlers. SOAP handlers can access the entire SOAP message, including the message headers and body. Logical handlers can access the payload of the message only, and cannot change any protocol-specific information (like headers) in a message.
18.2 Adding Server-side SOAP Message Handlers: Main Steps

The following procedure describes the high-level steps to add SOAP message handlers to your web service.

It is assumed that you have created a basic JWS file that implements a web service and that you want to update the web service by adding SOAP message handlers and handler chains. It is also assumed that you have set up an Ant-based development environment and that you have a working `build.xml` file that includes a target for running the `jwsc` Ant task. For more information, see:

- Chapter 3, "Developing JAX-WS Web Services"
- Chapter 4, "Programming the JWS File"
- Chapter 8, "Developing Web Service Clients"

Table 18–1  Steps to Add SOAP Message Handlers to a Web Service

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design the handlers and handler chains.</td>
<td>Design SOAP message handlers and group them together in a handler chain. See Section 18.4, &quot;Designing the SOAP Message Handlers and Handler Chains&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>For each handler in the handler chain, create a Java class that implements the SOAP message handler interface.</td>
<td>See Section 18.5, &quot;Creating the SOAP Message Handler&quot;.</td>
</tr>
<tr>
<td>3</td>
<td>Update your JWS file, adding annotations to configure the SOAP message handlers.</td>
<td>See Section 18.6, &quot;Configuring Handler Chains in the JWS File&quot;.</td>
</tr>
<tr>
<td>4</td>
<td>Create the handler chain configuration file.</td>
<td>See Section 18.7, &quot;Creating the Handler Chain Configuration File&quot;.</td>
</tr>
<tr>
<td>5</td>
<td>Compile all handler classes in the handler chain and rebuild your web service.</td>
<td>See Section 18.8, &quot;Compiling and Rebuilding the Web Service&quot;.</td>
</tr>
</tbody>
</table>

18.3 Adding Client-side SOAP Message Handlers: Main Steps

You can configure client-side SOAP message handlers for both standalone clients and clients that run inside of WebLogic Server. You create the actual Java client-side handler in the same way you create a server-side handler (by creating a Java class that implements the SOAP message handler interface). In many cases you can use the exact same handler class on both the web service running on WebLogic Server and the client applications that invoke the web service. For example, you can write a generic logging handler class that logs all sent and received SOAP messages, both for the server and for the client.

The following procedure describes the high-level steps to add client-side SOAP message handlers to the client application that invokes a web service operation.
It is assumed that you have created the client application that invokes a deployed web service, and that you want to update the client application by adding client-side SOAP message handlers and handler chains. It is also assumed that you have set up an Ant-based development environment and that you have a working build.xml file that includes a target for running the clientgen Ant task. For more information, see Section 8.2, "Invoking a Web Service from a Java SE Client."

### Table 18–2 Steps to Add SOAP Message Handlers to a Web Service Client

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design the handlers and handler chains.</td>
<td>This step is similar to designing the server-side SOAP message handlers, except the perspective is from the client application, rather than a web service. See Section 18.4, &quot;Designing the SOAP Message Handlers and Handler Chains&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>For each handler in the handler chain, create a Java class that implements the SOAP message handler interface.</td>
<td>This step is similar to designing the server-side SOAP message handlers, except the perspective is from the client application, rather than a web service. See Section 18.5, &quot;Creating the SOAP Message Handler&quot; for details about programming a handler class.</td>
</tr>
<tr>
<td>3</td>
<td>Update your client to programmatically configure the SOAP message handlers.</td>
<td>See Section 18.9, &quot;Configuring the Client-side SOAP Message Handlers&quot;.</td>
</tr>
<tr>
<td>4</td>
<td>Update the build.xml file that builds your application, specifying to the clientgen Ant task the customization file.</td>
<td>See Section 18.8, &quot;Compiling and Rebuilding the Web Service&quot;.</td>
</tr>
<tr>
<td>5</td>
<td>Rebuild your client application by running the relevant task.</td>
<td>prompt&gt; ant build-client</td>
</tr>
</tbody>
</table>

When you next run the client application, the SOAP messaging handlers listed in the configuration file automatically execute before the SOAP request message is sent and after the response is received.

---

**Note:** You do not have to update your actual client application to invoke the client-side SOAP message handlers; as long as you specify to the clientgen Ant task the handler configuration file, the generated interface automatically takes care of executing the handlers in the correct sequence.

### 18.4 Designing the SOAP Message Handlers and Handler Chains

When designing your SOAP message handlers, you must decide:

- The number of handlers needed to perform the work.
- The sequence of execution.

You group SOAP message handlers together in a *handler chain*. Each handler in a handler chain may define methods for both inbound and outbound messages.

Typically, each SOAP message handler defines a separate set of steps to process the request and response SOAP message because the same type of processing typically must happen for the inbound and outbound message. You can, however, design a handler that processes only the SOAP request and does no equivalent processing of
the response. You can also choose not to invoke the next handler in the handler chain and send an immediate response to the client application at any point.

### 18.4.1 Server-side Handler Execution

When invoking a web service, WebLogic Server executes handlers as follows:

1. The *inbound* methods for handlers in the handler chain are all executed in the order specified by the JWS annotation. Any of these inbound methods might change the SOAP message request.
2. When the last handler in the handler chain executes, WebLogic Server invokes the back-end component that implements the web service, passing it the final SOAP message request.
3. When the back-end component has finished executing, the *outbound* methods of the handlers in the handler chain are executed in the reverse order specified by the JWS annotation. Any of these outbound methods might change the SOAP message response.
4. When the first handler in the handler chain executes, WebLogic Server returns the final SOAP message response to the client application that invoked the web service.

For example, assume that you are going to use the [@HandlerChain](#) JWS annotation in your JWS file to specify an external configuration file, and the configuration file defines a handler chain called `SimpleChain` that contains three handlers, as shown in the following sample:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<handler-chains xmlns="http://java.sun.com/xml/ns/javaee">
  <handler-chain>
    <handler>
      <handler-class>
        Handler1
      </handler-class>
    </handler>
  </handler-chain>
  <handler-chain>
    <handler>
      <handler-class>
        Handler2
      </handler-class>
    </handler>
  </handler-chain>
  <handler-chain>
    <handler>
      <handler-class>
        Handler3
      </handler-class>
    </handler>
  </handler-chain>
</handler-chains>
```

The following graphic shows the order in which WebLogic Server executes the inbound and outbound methods of each handler.
18.4.2 Client-side Handler Execution

In the case of a client-side handler, the handler executes twice:

- Directly before the client application sends the SOAP request to the web service
- Directly after the client application receives the SOAP response from the web service

18.5 Creating the SOAP Message Handler

There are two types of SOAP message handlers that you can create, as defined in the following table.

<table>
<thead>
<tr>
<th>Handler Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOAP handler</td>
<td>Enables you to access the full SOAP message including headers. SOAP handlers are defined using the javax.xml.ws.handler.soap.SOAPHandler interface. They are invoked using the import javax.xml.ws.handler.soap.SOAPMessageContext which extends javax.xml.ws.handler.MessageContext. The SOAPMessageContext.getMessage() method returns a javax.xml.soap.SOAPMessage.</td>
</tr>
<tr>
<td>Logical handlers</td>
<td>Provides access to the payload of the message. Logical handlers cannot change any protocol-specific information (like headers) in a message. Logical handlers are defined using the javax.xml.ws.handler.LogicalHandler interface (see <a href="http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/LogicalHandler.html">http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/LogicalHandler.html</a>). They are invoked using the javax.xml.ws.handler.LogicalMessageContext which extends javax.xml.ws.handler.MessageContext. The LogicalMessageContext.getMessage() method returns a javax.xml.ws.LogicalMessage. The payload can be accessed either as a JAXB object or as a javax.xml.transform.Source object (see <a href="http://docs.oracle.com/javaee/7/api/javax/xml/ws/LogicalMessage.html">http://docs.oracle.com/javaee/7/api/javax/xml/ws/LogicalMessage.html</a>).</td>
</tr>
</tbody>
</table>

Each type of message handler extends the javax.xml.ws.Handler interface (see http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/Handler.html), which defines the methods defined in the following table.
Creating the SOAP Message Handler

18.5.1 Example of a SOAP Handler

The following example illustrates a simple SOAP handler that returns whether the message is inbound or outbound along with the message content.

```java
package examples.webservices.handler;

import java.util.Set;
import java.util.Collections;
import javax.xml.namespace.QName;
import javax.xml.ws.handler.soap.SOAPHandler;
import javax.xml.ws.handler.MessageContext;
import javax.xml.soap.SOAPMessage;

public class Handler implements SOAPHandler<SOAPMessageContext>
{
    public Set<QName> getHeaders()
    {
        return Collections.emptySet();
    }

    public boolean handleMessage(SOAPMessageContext messageContext)
    {
        Boolean outboundProperty = (Boolean) messageContext.get (MessageContext.MESSAGE_OUTBOUND_PROPERTY);

        if (outboundProperty.booleanValue()) {
            System.out.println("Outbound message:");
        } else {
            System.out.println("Inbound message:");
        }

        System.out.println("** Response: " + messageContext.getMessage().toString());
    }
}
```

In addition, you can use the `@javax.annotation.PostConstruct` and `@javax.annotation.PreDestroy` annotations to identify methods that must be executed after the handler is created and before the handler is destroyed, respectively.

Sometimes you might need to directly view or update the SOAP message from within your handler, in particular when handling attachments, such as image. In this case, use the `javax.xml.soap.SOAPMessage` abstract class, which is part of the SOAP With Attachments API for Java 1.1 (SAAJ) specification at [http://java.net/projects/saaj](http://java.net/projects/saaj). For details, see Section 18.5.7, "Directly Manipulating the SOAP Request and Response Message Using SAAJ".

18.5.1 Example of a SOAP Handler

<table>
<thead>
<tr>
<th>Table 18–4</th>
<th>Handler Interface Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Description</td>
</tr>
<tr>
<td>getMessage()</td>
<td>Manages normal processing of inbound and outbound messages. A property in the <code>MessageContext</code> object is used to determine if the message is inbound or outbound. See Section 18.5.3, &quot;Implementing the Handler.getMessage() Method&quot;.</td>
</tr>
<tr>
<td>handleFault()</td>
<td>Manages fault processing of inbound and outbound messages. See Section 18.5.4, &quot;Implementing the Handler.handleFault() Method&quot;.</td>
</tr>
<tr>
<td>close()</td>
<td>Concludes the message exchange and cleans up resources that were accessed during processing. See Section 18.5.5, &quot;Implementing the Handler.close() Method&quot;.</td>
</tr>
</tbody>
</table>
return true;
}

public boolean handleFault(SOAPMessageContext messageContext)
{
    return true;
}

public void close(MessageContext messageContext)
{
    
}

### 18.5.2 Example of a Logical Handler

The following example illustrates a simple logical handler that returns whether the message is inbound or outbound along with the message content.

```java
package examples.webservices.handler;

import java.util.Set;
import java.util.Collections;
import javax.xml.namespace.QName;
import javax.xml.ws.handler.LogicalHandler;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.handler.LogicalMessageContext;
import javax.xml.ws.LogicalMessage;
import javax.xml.transform.Source;

public class Handler2 implements LogicalHandler<LogicalMessageContext>
{
    public Set<QName> getHeaders()
    {
        return Collections.emptySet();
    }

    public boolean handleMessage(LogicalMessageContext messageContext)
    {
        Boolean outboundProperty = (Boolean)
                                    messageContext.get(MessageContext.MESSAGE_OUTBOUND_PROPERTY);
        if (outboundProperty.booleanValue()) {
            System.out.println("Outbound message:");
        } else {
            System.out.println("Inbound message:");
        }

        System.out.println("** Response: "+messageContext.getMessage().toString());
        return true;
    }

    public boolean handleFault(LogicalMessageContext messageContext)
    {
        return true;
    }

    public void close(MessageContext messageContext)
    {
    }
}
```
18.5.3 Implementing the Handler.handleMessage() Method

The Handler.handleMessage() method is called to intercept a SOAP message request before and after it is processed by the back-end component. Its signature is:

```java
public boolean handleMessage(C context)
    throws java.lang.RuntimeException, java.xml.ws.ProtocolException {}
```

Implement this method to perform such tasks as encrypting/decrypting data in the SOAP message before or after it is processed by the back-end component, and so on.

C extends javax.xml.ws.handler.MessageContext (see http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContext.html). The MessageContext properties allow the handlers in a handler chain to determine if a message is inbound or outbound and to share processing state. Use the SOAPMessageContext or LogicalMessageContext sub-interface of MessageContext to get or set the contents of the SOAP or logical message, respectively. For more information, see Section 18.5.6, “Using the Message Context Property Values and Methods”.

After you code all the processing of the SOAP message, code one of the following scenarios:

- Invoke the next handler on the handler request chain by returning true.
  
  The next handler on the request chain is specified as the next <handler>
  subelement of the <handler-chain> element in the configuration file specified by
  the @HandlerChain annotation.

- Block processing of the handler request chain by returning false.
  
  Blocking the handler request chain processing implies that the back-end
  component does not get executed for this invoke of the web service. You might
  want to do this if you have cached the results of certain invokes of the web service,
  and the current invoke is on the list.

  Although the handler request chain does not continue processing, WebLogic
  Server does invoke the handler response chain, starting at the current handler.

- Throw the java.lang.RuntimeException or java.xml.ws.ProtocolException for
  any handler-specific runtime errors.

  WebLogic Server catches the exception, terminates further processing of the
  handler request chain, logs the exception to the WebLogic Server log file, and
  invokes the handleFault() method of this handler.

18.5.4 Implementing the Handler.handleFault() Method

The Handler.handleFault() method processes the SOAP faults based on the SOAP message processing model. Its signature is:

```java
public boolean handleFault(C context)
    throws java.lang.RuntimeException, java.xml.ws.ProtocolException{}
```

Implement this method to handle processing of any SOAP faults generated by the handleMessage() method, as well as faults generated by the back-end component.

C extends javax.xml.ws.handler.MessageContext (see http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContext.html). The MessageContext properties allow the handlers in a handler chain to determine if a message is inbound or outbound and to share processing state. Use the LogicalMessageContext or SOAPMessageContext sub-interface of MessageContext to
get or set the contents of the logical or SOAP message, respectively. For more information, see Section 18.5.6, "Using the Message Context Property Values and Methods".

After you code all the processing of the SOAP fault, do one of the following:

- Invoke the `handleFault()` method on the next handler in the handler chain by returning `true`.
- Block processing of the handler fault chain by returning `false`.

### 18.5.5 Implementing the Handler.close() Method

The `Handler.close()` method concludes the message exchange and cleans up resources that were accessed during processing. Its signature is:

```java
public boolean close(MessageContext context) {} 
```

### 18.5.6 Using the Message Context Property Values and Methods

The following context objects are passed to the SOAP message handlers.

#### Table 18–5 Message Context Property Values

<table>
<thead>
<tr>
<th>Message Context Property Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>javax.xml.ws.handler.LogicalMessageContext</code></td>
<td>Context object for logical handlers.</td>
</tr>
<tr>
<td><code>javax.xml.ws.handler.soap.SOAPMessageContext</code></td>
<td>Context object for SOAP handlers.</td>
</tr>
</tbody>
</table>

Each context object extends `javax.xml.ws.handler.MessageContext`, which enables you to access a set of runtime properties of a SOAP message handler from the client application or web service, or directly from the `javax.xml.ws.WebServiceContext` from a web service (see [https://jax-ws.java.net/nonav/jax-ws-2.0-pfd/api/javax/xml/ws/WebServiceContext.html](https://jax-ws.java.net/nonav/jax-ws-2.0-pfd/api/javax/xml/ws/WebServiceContext.html)).

For example, the `MessageContext.MESSAGE_OUTBOUND_PROPERTY` holds a Boolean value that is used to determine the direction of a message. During a request, you can check the value of this property to determine if the message is an inbound or outbound request. The property would be `true` when accessed by a client-side handler or `false` when accessed by a server-side handler.

For more information about the `MessageContext` property values that are available, see Section 4.4.3, "Using the MessageContext Property Values."

The `LogicalMessageContext` class defines the following method for processing the Logical message. For more information, see the `java.xml.ws.handler.LogicalMessageContext` Javadoc at [http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/LogicalMessageContext.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/LogicalMessageContext.html).

#### Table 18–6 LogicalMessageContext Class Method

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getMessage()</td>
<td>Gets a <code>javax.xml.ws.LogicalMessage</code> object that contains the SOAP message.</td>
</tr>
</tbody>
</table>
The SOAPMessageContext class defines the following methods for processing the SOAP message. For more information, see the java.xml.ws.handler.soap.SOAPMessageContext Javadoc at http://docs.oracle.com/javaee/7/api/java/xml/ws/handler/soap/SOAPMessageContext.html.

**Note:** The SOAP message itself is stored in a javax.xml.soap.SOAPMessage object at http://docs.oracle.com/javaee/7/api/java/xml/soap/SOAPMessage.html. For detailed information on this object, see Section 18.5.7, "Directly Manipulating the SOAP Request and Response Message Using SAAJ".

### Table 18–7 SOAPMessageContext Class Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>getHeaders()</td>
<td>Gets headers that have a particular qualified name from the message in the message context.</td>
</tr>
<tr>
<td>getMessage()</td>
<td>Gets a javax.xml.soap.SOAPMessage object that contains the SOAP message.</td>
</tr>
<tr>
<td>getRoles()</td>
<td>Gets the SOAP actor roles associated with an execution of the handler chain.</td>
</tr>
<tr>
<td>setMessage()</td>
<td>Sets the SOAP message.</td>
</tr>
</tbody>
</table>

#### 18.5.7 Directly Manipulating the SOAP Request and Response Message Using SAAJ

The javax.xml.soap.SOAPMessage abstract class is part of the SOAP With Attachments API for Java 1.1 (SAAJ) specification at http://java.sun.com/webservices/saaj/docs.html. You use the class to manipulate request and response SOAP messages when creating SOAP message handlers. This section describes the basic structure of a SOAPMessage object and some of the methods you can use to view and update a SOAP message.

A SOAPMessage object consists of a SOAPPart object (which contains the actual SOAP XML document) and zero or more attachments.

Refer to the SAAJ Javadocs for the full description of the SOAPMessage class.

#### 18.5.7.1 The SOAPPart Object

**Note:** The setContent and getContent methods of the SOAPPart object support javax.xml.transform.stream.StreamSource content only; the methods do not support javax.xml.transform.dom.DOMSource content.

The SOAPPart object contains the XML SOAP document inside of a SOAPEnvelope object. You use this object to get the actual SOAP headers and body.

The following sample Java code shows how to retrieve the SOAP message from a MessageContext object, provided by the Handler class, and get at its parts:

```java
SOAPMessage soapMessage = messageContext.getMessage();
SOAPPart soapPart = soapMessage.getSOAPPart();
SOAPEnvelope soapEnvelope = soapPart.getEnvelope();
```
SOAPBody soapBody = soapEnvelope.getBody();
SOAPHeader soapHeader = soapEnvelope.getHeader();

### 18.5.7.2 The AttachmentPart Object

The `javax.xml.soap.AttachmentPart` object (see [http://docs.oracle.com/javaee/7/api/javax/xml/soap/AttachmentPart.html](http://docs.oracle.com/javaee/7/api/javax/xml/soap/AttachmentPart.html)) contains the optional attachments to the SOAP message. Unlike the rest of a SOAP message, an attachment is not required to be in XML format and can therefore be anything from simple text to an image file.

**Note:** If you are going to access a `java.awt.Image` attachment from your SOAP message handler, see Section 18.5.7.3, "Manipulating Image Attachments in a SOAP Message Handler" for important information.

Use the following methods of the `SOAPMessage` class to manipulate the attachments. For more information, see the [javax.xml.soap.SOAPMessage Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/soap/SOAPMessage.html](http://docs.oracle.com/javaee/7/api/javax/xml/soap/SOAPMessage.html).

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>addAttachmentPart()</td>
<td>Adds an AttachmentPart object, after it has been created, to the SOAPMessage.</td>
</tr>
<tr>
<td>countAttachments()</td>
<td>Returns the number of attachments in this SOAP message.</td>
</tr>
<tr>
<td>createAttachmentPart()</td>
<td>Create an AttachmentPart object from another type of Object.</td>
</tr>
<tr>
<td>getAttachments()</td>
<td>Gets all the attachments (as AttachmentPart objects) into an Iterator object.</td>
</tr>
</tbody>
</table>

### 18.5.7.3 Manipulating Image Attachments in a SOAP Message Handler

It is assumed in this section that you are creating a SOAP message handler that accesses a `java.awt.Image` attachment and that the `Image` has been sent from a client application that uses the client JAX-WS ports generated by the `clientgen` Ant task.

In the client code generated by the `clientgen` Ant task, a `java.awt.Image` attachment is sent to the invoked WebLogic web service with a MIME type of `text/xml` rather than `image/gif`, and the image is serialized into a stream of integers that represents the image. In particular, the client code serializes the image using the following format:

- int width
- int height
- int[] pixels

This means that, in your SOAP message handler that manipulates the received Image attachment, you must deserialize this stream of data to then re-create the original image.

### 18.6 Configuring Handler Chains in the JWS File

The `@javax.jws.HandlerChain` annotation (also called `@HandlerChain` in this chapter for simplicity) enables you to configure a handler chain for a web service. Use the file...
attribute to specify an external file that contains the configuration of the handler chain you want to associate with the web service. The configuration includes the list of handlers in the chain, the order in which they execute, the initialization parameters, and so on.

The following JWS file shows an example of using the @HandlerChain annotation; the relevant Java code is shown in bold:

```java
package examples.webservices.handler;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.HandlerChain;
import javax.annotation.Resource;
import javax.xml.ws.WebServiceContext;

@WebService(name = "Handler", targetNamespace = "http://example.org")
@HandlerChain(file="handler-chain.xml")
public class HandlerWS
{
    @Resource
    WebServiceContext ctx;
    @WebMethod()
    public String getProperty(String propertyName)
    {
        return (String) ctx.getMessageContext().get(propertyName);
    }
}
```

Before you use the @HandlerChain annotation, you must import it into your JWS file, as shown above.

Use the file attribute of the @HandlerChain annotation to specify the name of the external file that contains configuration information for the handler chain. The value of this attribute is a URL, which may be relative or absolute. Relative URLs are relative to the location of the JWS file at the time you run the jwsc Ant task to compile the file.

**Note:** It is an error to specify more than one @HandlerChain annotation in a single JWS file.

For details about creating the external configuration file, see Section 18.7, "Creating the Handler Chain Configuration File".

For additional detailed information about the standard JWS annotations discussed in this section, see the web services Metadata for the Java Platform specification at http://www.jcp.org/en/jsr/detail?id=181.

### 18.7 Creating the Handler Chain Configuration File

As described in the previous section, you use the @HandlerChain annotation in your JWS file to associate a handler chain with a web service. You must create the handler chain file that consists of an external configuration file that specifies the list of handlers in the handler chain, the order in which they execute, the initialization parameters, and so on.

Because this file is external to the JWS file, you can configure multiple web services to use this single configuration file to standardize the handler configuration file for all web services in your enterprise. Additionally, you can change the configuration of the handler chains without needing to recompile all your web services.
The configuration file uses XML to list one or more handler chains, as shown in the following simple example:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<handler-chains xmlns="http://java.sun.com/xml/ns/javaee">
  <handler-chain>
    <handler>
      <handler-class>examples.webservices.handler.Handler1</handler-class>
    </handler>
  </handler-chain>
  <handler-chain>
    <handler>
      <handler-class>examples.webservices.handler.Handler2</handler-class>
    </handler>
  </handler-chain>
</handler-chains>
```

In the example, the handler chain contains two handlers implemented with the class names specified with the `<handler-class>` element. The two handlers execute in forward order before the relevant web service operation executes, and in reverse order after the operation executes.

Use the `<init-param>` and `<soap-role>` child elements of the `<handler>` element to specify the handler initialization parameters and SOAP roles implemented by the handler, respectively.

You can include logical and SOAP handlers in the same handler chain. At runtime, the handler chain is re-ordered so that all logical handlers are executed before SOAP handlers for an outbound message, and vice versa for an inbound message.

For the XML Schema that defines the external configuration file, additional information about creating it, and additional examples, see the web services Metadata for the Java Platform specification at [http://www.jcp.org/en/jsr/detail?id=181](http://www.jcp.org/en/jsr/detail?id=181).

### 18.8 Compiling and Rebuilding the Web Service

It is assumed in this section that you have a working `build.xml` Ant file that compiles and builds your web service, and you want to update the build file to include handler chain. See Section 3, "Developing JAX-WS Web Services" for information on creating this `build.xml` file.

Follow these guidelines to update your development environment to include message handler compilation and building:

- After you have updated the JWS file with the `@HandlerChain` annotation, you must rerun the `jwsc` Ant task to recompile the JWS file and generate a new web service. This is true anytime you make a change to an annotation in the JWS file.
  
  If you used the `@HandlerChain` annotation in your JWS file, reran the `jwsc` Ant task to regenerate the web service, and subsequently changed only the external configuration file, you do not need to rerun `jwsc` for the second change to take affect.

- The `jwsc` Ant task compiles SOAP message handler Java files into handler classes (and then packages them into the generated application) if all the following conditions are true:
  
  - The handler classes are referenced in the `@HandlerChain` annotation of the JWS file.
- The Java files are located in the directory specified by the sourcepath attribute.
- The classes are not currently in your CLASSPATH.

If you want to compile the handler classes yourself, rather than let jwsc compile them automatically, ensure that the compiled classes are in your CLASSPATH before you run the jwsc Ant task.

- You deploy and invoke a web service that has a handler chain associated with it in the same way you deploy and invoke one that has no handler chain. The only difference is that when you invoke any operation of the web service, the WebLogic web services runtime executes the handlers in the handler chain both before and after the operation invoke.

### 18.9 Configuring the Client-side SOAP Message Handlers

You configure client-side SOAP message handlers in one of the following ways:

- **Set a handler chain directly on the javax.xml.ws.BindingProvider**, such as a port proxy or javax.xml.ws.Dispatch object. For example:

```java
package examples.webservices.handler.client;

import javax.xml.namespace.QName;
import java.net.MalformedURLException;
import java.net.URL;
import javax.xml.ws.handler.Handler;
import javax.xml.ws.Binding;
import javax.xml.ws.BindingProvider;
import java.util.List;
import examples.webservices.handler.Handler1;
import examples.webservices.handler.Handler2;

public class Main {
    public static void main(String[] args) {
        HandlerWS test;
        try {
            test = new HandlerWS(new URL(args[0] + '?WSDL'), new QName("http://example.org", "HandlerWS") );
        } catch (MalformedURLException murl) { throw new RuntimeException(murl); }
        HandlerWSPortType port = test.getHandlerWSPortTypePort();
        Binding binding = ((BindingProvider)port).getBinding();
        List<Handler> handlerList = binding.getHandlerChain();
        handlerList.add(new Handler1());
        handlerList.add(new Handler2());
        binding.setHandlerChain(handlerList);
        String result = null;
        result = port.sayHello("foo bar");
        System.out.println("Got result: " + result);
    }
}
```

- **Implement a javax.xml.ws.handler.HandlerResolver** on a Service instance. For example:

```java
public static class MyHandlerResolver implements HandlerResolver {
```

---

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public List<Handler> getHandlerChain(PortInfo portInfo) {
    List<Handler> handlers = new ArrayList<Handler>();
    // add handlers to list based on PortInfo information
    return handlers;
}
}

Add a handler resolver to the Service instance using the setHandlerResolver() method. In this case, the port proxy or Dispatch object created from the Service instance uses the HandlerResolver to determine the handler chain. For example:

    test.setHandlerResolver(new MyHandlerResolver());

- Create a customization file that includes a <binding> element that contains a handler chain description. The schema for the <handler-chains> element is the same for both handler chain files (on the server) and customization files. For example:

    <bindings xmlns:xsd="http://www.w3.org/2001/XMLSchema"
        xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
        wsdlLocation="http://localhost:7001/handler/HandlerWS?WSDL"
        xmlns="http://java.sun.com/xml/ns/jaxws">
        <bindings node="wsdl:definitions"
            xmlns:jws="http://java.sun.com/xml/ns/javaee">
            <handler-chains>
                <handler-chain>
                    <handler>
                        <handler-class>examples.webservices.handler.Handler1
                    </handler-class>
                </handler>
            </handler-chain>
            <handler-chain>
                <handler>
                    <handler-class>examples.webservices.handler.Handler2
                </handler-class>
            </handler-chain>
            </handler-chains>
        </bindings>
    </bindings>

Use the <binding> child element of the clientgen command to pass the customization file.
Handling Exceptions Using SOAP Faults

This chapter describes how to handle exceptions that occur when a message is being processed using Simple Object Access Protocol (SOAP) faults for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 19.1, "Overview of Exception Handling Using SOAP Faults"
- Section 19.2, "Contents of the SOAP Fault Element"
- Section 19.3, "Using Modeled Faults"
- Section 19.4, "Using Unmodeled Faults"
- Section 19.5, "Customizing the Exception Handling Process"
- Section 19.6, "Disabling the Stack Trace from the SOAP Fault"
- Section 19.7, "Other Exceptions"

19.1 Overview of Exception Handling Using SOAP Faults

When a web service request is being processed, if an error is encountered, the nature of the error needs to be communicated to the client, or sender of the request. Because clients can be written on a variety of platforms using different languages, there must exist a standard, platform-independent mechanism for communicating the error.

The SOAP specification (available at http://www.w3.org/TR/soap/) defines a standard, platform-independent way of describing the error within the SOAP message using a SOAP fault. In general, a SOAP fault is analogous to an application exception. SOAP faults are generated by receivers to report business logic errors or unexpected conditions.

In JAX-WS, Java exceptions (java.lang.Exception) that are thrown by your Java web service are mapped to a SOAP fault and returned to the client to communicate the reason for failure. SOAP faults can be one of the following types:

- Modeled—Maps to an exception that is thrown explicitly from the business logic of the Java code and mapped to wsdl:fault definitions in the WSDL file, when the web service is deployed. In this case, the SOAP faults are predefined.

- Unmodeled—Maps to an exception (for example, java.lang.RuntimeException) that is generated at run-time when no business logic fault is defined in the WSDL. In this case, Java exceptions are represented as generic SOAP fault exceptions, javax.xml.ws.soap.SOAPFaultException.
The faults are returned to the sender only if request/response messaging is in use. If a web service operation is configured as one-way, the SOAP fault is not returned to the sender, but stored for further processing.

As illustrated in Figure 19–1, JAX-WS handles SOAP fault processing during SOAP protocol binding. The SOAP binding maps exceptions to SOAP fault messages.

Figure 19–1  How SOAP Faults Are Processed

19.2 Contents of the SOAP Fault Element

The SOAP <Fault> element is used to transmit error and status information within a SOAP message. The <Fault> element is a child of the body element. There can be only one <Fault> element in the body of a SOAP message.

The SOAP <Fault> element contents for SOAP 1.2 and 1.1 are defined in the following sections:

- Section 19.2.1, "SOAP 1.2 <Fault> Element Contents"
- Section 19.2.2, "SOAP 1.1 <Fault> Element Contents"

19.2.1 SOAP 1.2 <Fault> Element Contents

The <Fault> element for SOAP 1.2 contains the subelements defined in Table 19–1.
The following provides an example of a SOAP 1.2 fault message.

**Example 19–1 Example of SOAP 1.2 Fault Message**

```xml
<?xml version="1.0"?>
<env:Envelope xmlns:env=http://www.w3.org/2003/05/soap-envelope>
  <env:Body>
    <env:Fault>
      <env:Code>
        <env:Value>env:Sender</env:Value>
        <env:Subcode>
          <env:Value>rpc:BadArguments</env:Value>
        </env:Subcode>
      </env:Code>
      <env:Reason>
      </env:Reason>
    </env:Fault>
    <e:myFaultDetails xmlns:e=http://travelcompany.example.org/faults>
      <e:message>Name does not match card number</e:message>
      <e:errorcode>999</e:errorcode>
    </e:myFaultDetails>
  </env:Body>
</env:Envelope>
```
19.2.2 SOAP 1.1 <Fault> Element Contents

The <Fault> element for SOAP 1.1 contains the subelements defined in Table 19–2.

**Table 19–2 Subelements of the SOAP 1.1 <Fault> Element**

<table>
<thead>
<tr>
<th>Subelement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>faultcode</td>
<td>Standard code that provides more information about the fault. A set of code values is predefined by the SOAP specification, as defined below. This set of fault code values can be extended by the application. Predefined fault code values include:</td>
</tr>
<tr>
<td></td>
<td>■ MustUnderstand—SOAP header entry not understood by processing party.</td>
</tr>
<tr>
<td></td>
<td>■ Client—Message was incorrectly formatted or is missing information.</td>
</tr>
<tr>
<td></td>
<td>■ Server—Problem with the server that prevented message from being processed.</td>
</tr>
<tr>
<td>faultstring</td>
<td>Human-readable description of fault.</td>
</tr>
<tr>
<td>faultactor</td>
<td>URI associated with the actor (SOAP node) that caused the fault. In RPC-style messaging, the actor is the URI of the web service.</td>
</tr>
<tr>
<td>detail</td>
<td>Application-specific information, such as the exception that was thrown. This element can be an XML structure or plain text.</td>
</tr>
</tbody>
</table>

The following provides an example of a SOAP 1.1 fault message.

**Example 19–2 Example of SOAP 1.1 Fault Message**

```xml
<?xml version="1.0"?>
<soap:Envelope
 xmlns:soap='http://schemas.xmlsoap.org/soap/envelope'>
 <soap:Body>
   <soap:Fault>
     <faultcode>soap:VersionMismatch</faultcode>
     <faultstring, xml:lang='en'>Message was not SOAP 1.1 compliant</faultstring>
     <faultactor>
       http://sample.org.ocm/jws/authnticator
     </faultactor>
   </soap:Fault>
 </soap:Body>
</soap:Envelope>
```

19.3 Using Modeled Faults

As described previously, a modeled fault is mapped to an exception that is thrown explicitly from the business logic of the Java code. In this case, the exception is mapped to a wsdl:Fault definitions in the WSDL file, when the web service is deployed.

The following sections provide more information about using modeled faults:
19.3.1 Creating and Using a Custom Exception

To use modeled faults, you need to create a custom Java exception and throw it from within your web service.

Example 19–3 provides a simple example of a custom exception being thrown by a web service. The exception is called MissingName and is thrown when the input argument is empty.

Example 19–3 Web Service With Custom Exception

```java
package examples;
import javax.jws.WebService;

@WebService(name="HelloWorld", serviceName="HelloWorldService")
public class HelloWorld {
    public String sayHelloWorld(String message) throws MissingName {
        System.out.println("Say Hello World: "+ message);
        if (message == null || message.isEmpty()) {
            throw new MissingName();
        }
        return "Here is the message: "+ message + ";";
    }
}
```

Example 19–4 shows the class for the exception, MissingName.java.

Example 19–4 Custom Exception Class (MissingName)

```java
package examples;
import java.lang.Exception;

public class MissingName extends Exception {
    public MissingName() {
        super("Your name is required.");
    }
}
```

19.3.2 How Modeled Faults are Mapped in the WSDL File

The JAX-WS Java-to-WSDL mapping binds subclasses of java.lang.Exception to wsdl:fault messages. Example 19–4 shows the WSDL that is generated from the annotated web service in Example 19–3.*

In this example:

- The <message name="MissingName"> element defines the parts of the MissingName message, namely fault, and its associated data type, tns:MissingName.

```xml
<message name="MissingName">
    <part name="fault" element="tns:MissingName" />
</message>
```
The **MissingName** SOAP fault is mapped to the *sayHelloWorld* operation.

```xml
<operation name="sayHelloWorld">
  <input message="tns:sayHelloWorld" />
  <output message="tns:sayHelloWorldResponse" />
  <fault message="tns:MissingName" name="MissingName" />
</operation>
```

This `<fault>` subelement in this example is derived from the `throws MissingName` clause of the `sayHelloWorld()` method declaration (see Example 19–3).

```java
public String sayHelloWorld(String message) throws MissingName {
  ...
}
```

The fault message is mapped to the `sayHelloWorld` operation in the `<binding>` element, as well.

```xml
<fault name="MissingName">
  <soap:fault name="MissingName" use="literal" />
</fault>
```

---

**Example 19–5  Example of WSDL with Modeled Exceptions**

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<definitions
  xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
  xmlns:tns="http://examples/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://schemas.xmlsoap.org/wsdl/"
  targetNamespace="http://examples/"
  name="HelloWorldService">
  <types>
    <xsd:schema>
      <xsd:import namespace="http://examples/"
    </xsd:schema>
  </types>
  <message name="sayHelloWorld">
    <part name="parameters" element="tns:sayHelloWorld" />
  </message>
  <message name="sayHelloWorldResponse">
    <part name="parameters" element="tns:sayHelloWorldResponse" />
  </message>
  <message name="MissingName">
    <part name="fault" element="tns:MissingName" />
  </message>
  <portType name="HelloWorld">
    <operation name="sayHelloWorld">
      <input message="tns:sayHelloWorld" />
      <output message="tns:sayHelloWorldResponse" />
      <fault message="tns:MissingName" name="MissingName" />
    </operation>
  </portType>
  <binding name="HelloWorldPortBinding" type="tns:HelloWorld">
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http"
      style="document" />
    <operation name="sayHelloWorld">
      <soap:operation soapAction="" />
      <input>
        <soap:body use="literal" />
      </input>
    </operation>
  </binding>
</definitions>
```
Using Modeled Faults

Handling Exceptions Using SOAP Faults

19.3.3 How the Fault is Communicated in the SOAP Message

Example 19–6 shows how the SOAP fault is communicated in the resulting SOAP message when the MissingName Java exception is thrown.

Example 19–6  Example SOAP Fault Message for MissingName Exception

```xml
<?xml version='1.0' encoding='UTF-8'?>
<S:Envelope xmlns:S="http://schemas.xmlsoap.org/soap/envelope/">
  <S:Body>
    <S:Fault xmlns:ns4="http://www.w3.org/2003/05/soap-envelope">
      <faultcode>S:Server</faultcode>
      <faultstring>Your name is required.</faultstring>
      <detail>
        <ns2:MissingName xmlns:ns2="http://examples/">
          <message>Your name is required.</message>
        </ns2:MissingName>
        <ns2:exception xmlns:ns2="http://jax-ws.java.net/"
            class="examples.MissingName" note="To disable this feature, set com.sun.xml.ws.fault.SOAPFaultBuilder.disableCaptureStackTrace system property to false">
          <message>Your name is required.</message>
          <ns2:stackTrace>
            <ns2:frame class="examples.HelloWorld" file="HelloWorld.java" line="14" method="sayHelloWorld"/>
            ...
          </ns2:stackTrace>
        </ns2:exception>
      </detail>
    </S:Fault>
  </S:Body>
</S:Envelope>
```

19.3.4 Creating the Web Service Client

When you generate a web service client from a WSDL file that contains mapped faults using clientgen, the required exception classes are generated automatically, including the mapped exception, fault bean, service implementation classes client implementation class, which you must modify, as described in the following sections.

- Section 19.3.4.1, "Reviewing the Generated Java Exception Class"
- Section 19.3.4.2, "Reviewing the Generated Java Fault Bean Class"
- **Section 19.3.4.3, "Reviewing the Client-side Service Implementation"
- **Section 19.3.4.4, "Creating the Client Implementation Class"

For more information about clientgen, see "clientgen" in *WebLogic Web Services Reference for Oracle WebLogic Server*.

### 19.3.4.1 Reviewing the Generated Java Exception Class

An example of the generated Java exception class is shown in Example 19–7. The `@WebFault` annotation identifies the class as a mapped exception.

**Example 19–7  Example of Generated Java Exception Class**

```java
package examples.client;

import javax.xml.ws.WebFault;

@WebFault(name = "MissingName", targetNamespace = "http://examples/"
public class MissingName_Exception extends Exception {
    private MissingName faultInfo;
    public MissingName_Exception(String message, MissingName faultInfo) { ... }
    public MissingName_Exception(String message, MissingName faultInfo,
        Throwable cause) { ... }
    public MissingName getFaultInfo() { ... }
}
```

### 19.3.4.2 Reviewing the Generated Java Fault Bean Class

An example of the generated Java fault bean class is shown in Example 19–8, defining the getters and setters for the fault message.

**Example 19–8  Example of Generated Java Fault Bean Class**

```java
package examples.client;

import javax.xml.bind.annotation.XmlAccessType;
import javax.xml.bind.annotation.XmlAccessorType;
import javax.xml.bind.annotation.XmlType;

@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "MissingName", propOrder = {
    "message"
})
public class MissingName {
    protected String message;

    public String getMessage() {
        return message;
    }

    public void setMessage(String value) {
        this.message = value;
    }
}
```
19.3.4.3 Reviewing the Client-side Service Implementation

An example of the generated client-side service implementation class is shown in Example 19–9.

**Example 19–9  Client-side Service Implementation**

```java
package examples.client;
...
@WebService(name = "HelloWorld", targetNamespace = "http://examples/")
@XmlSeeAlso({
    ObjectFactory.class
})
public interface HelloWorld {

    @WebMethod
    @WebResult(targetNamespace = "")
    @RequestWrapper(localName = "sayHelloWorld",
        targetNamespace = "http://examples/",
        className = "examples.client.SayHelloWorld")
    @ResponseWrapper(localName = "sayHelloWorldResponse",
        targetNamespace = "http://examples/",
        className = "examples.client.SayHelloWorldResponse")
    public String sayHelloWorld(
        @WebParam(name = "arg0", targetNamespace = "")
        String arg0)
            throws MissingName_Exception;
}
```

19.3.4.4 Creating the Client Implementation Class

Create the client implementation class to call the web service method and throw the custom exception. Then, compile and run the client. For more information about creating web service clients, see "Invoking Web Services" in *Developing JAX-WS Web Services for Oracle WebLogic Server*.

**Example 19–10  Client Implementation Class**

```java
package examples.client;
import javax.xml.namespace.QName;
import java.net.MalformedURLException;
import java.net.URL;
import examples.client.MissingName_Exception;
public class Main {
    public static void main(String[] args) throws MissingName_Exception {
        HelloWorldService service;
        try {
            service = new HelloWorldService(new URL(args[0] + "?WSDL"),
                new QName("http://examples/", "HelloWorldService") );
        } catch (MalformedURLException murl) { throw new RuntimeException(murl); }
        HelloWorld port = service.getHelloWorldPort();
        String result = null;
        try {
            ...
19.4 Using Unmodeled Faults

As noted previously, an unmodeled fault maps to an exception (for example, `java.lang.RuntimeException`) that is generated at run-time when no business logic fault is defined in the WSDL. In this case, Java exceptions are represented as generic SOAP fault exceptions, `javax.xml.ws.soap.SOAPFaultException`.

The following shows an example of an exception that maps to an unmodeled fault.

**Example 19–11  Example of Web Service Using Unmodeled Fault**

```java
package examples;
import javax.jws.WebService;
@WebService(name="HelloWorld", serviceName="HelloWorldService")
public class HelloWorld {
    public String sayHelloWorld(String message) throws MissingName {
        System.out.println("Say Hello World: " + message);
        if (message == null || message.isEmpty()) {
            throw new MissingName(); // Modeled fault
        } else if (message.equalsIgnoreCase("abc")) {
            throw new RuntimeException("Please enter a name."); //Unmodeled fault
        }

        return "Here is the message: '{" + message + "'");
    }
}
```

In this example, if the string "abc" is passed to the method, the following `SOAPFaultException` and `RuntimeException` messages are returned in the log file:

**Example 19–12  Example of Log File Message for Unmodeled Fault**

```... run:
[java] Exception in thread 'main' javax.xml.ws.soap.SOAPFaultException: Please enter a name.
... Caused by: java.lang.RuntimeException: Please enter a name.
...```

19.5 Customizing the Exception Handling Process

You can customize the SOAP fault handling process using SOAP message handlers. A SOAP message handler provides a mechanism for intercepting the SOAP message in both the request and response of the web service. You can create SOAP message handlers to enable web services and clients to perform additional processing on the SOAP message. For more information, see Chapter 18, "Creating and Using SOAP Message Handlers."
Disabling the Stack Trace from the SOAP Fault

By default, the entire stack trace, including nested exceptions, is included in the details of the SOAP fault message. For example, the following shows an example of a SOAP fault message that includes the stack trace:

Example 19–13 Example of Stack Trace in SOAP Fault Message

```xml
<?xml version='1.0' encoding='UTF-8'?>
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope">
  <S:Body>
    <S:Fault xmlns:ns4="http://schemas.xmlsoap.org/soap/envelope/">
      <S:Code>
        <S:Value>S:Receiver</S:Value>
      </S:Code>
      <S:Reason>
        <S:Text xml:lang="en">String index out of range: 3</S:Text>
      </S:Reason>
      <S:Detail>
        <ns2:exception xmlns:ns2="http://jax-ws.java.net/"
          class="java.lang.StringIndexOutOfBoundsException" note="To disable this feature, set com.sun.xml.ws.fault.SOAPFaultBuilder.disableCaptureStackTrace system property to false">
          <message>String index out of range: 3</message>
          <ns2:stackTrace>
            <ns2:frame class="java.lang.String" file="String.java" line="1934" method="substring"/>
            <ns2:frame class="ratingservice.CreditRating" file="CreditRating.java" line="21" method="processRating"/>
            <ns2:frame class="sun.reflect.NativeMethodAccessorImpl" file="NativeMethodAccessorImpl.java" line="native" method="invoke0"/>
            <ns2:frame class="sun.reflect.NativeMethodAccessorImpl" file="NativeMethodAccessorImpl.java" line="39" method="invoke"/>
            <ns2:frame class="sun.reflect.DelegatingMethodAccessorImpl" file="DelegatingMethodAccessorImpl.java" line="25" method="invoke"/>
            <ns2:frame class="java.lang.reflect.Method" file="Method.java" line="597" method="invoke"/>
          ...
        </ns2:stackTrace>
      </ns2:exception>
    </S:Detail>
  </S:Body>
</S:Envelope>
```

You can disable the inclusion of the stack trace in the SOAP fault message by setting the com.sun.xml.ws.fault.SOAPFaultBuilder.disableCaptureStackTrace Java startup property to false.

To disable the stack trace:

1. Locate the following entry in the ORACLE_HOME/user_projects/domains/domainName/startWebLogic.cmd file, where ORACLE_HOME is
the directory you specified as the Oracle Home when you installed Oracle
WebLogic Server:

```bash
set JAVA_OPTIONS=%SAVE_JAVA_OPTIONS%
```

2. Edit the entry as follows:

```bash
set JAVA_OPTIONS=-Dcom.sun.xml.ws.fault.SOAFAULTBuilder.disableCaptureStackTrace=false %SAVE_JAVA_OPTIONS%
```

3. Save the `startWebLogic.cmd` file.

### 19.7 Other Exceptions

Note that in addition to the custom exceptions that are thrown explicitly in your web
service and the `SOAPFaultExceptions` that are used to map exceptions that are not
caught by your business logic, there are two other exceptions that might be
communicated to the web service client, and that you should be aware of.

<table>
<thead>
<tr>
<th>Table 19–3 Other Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exception</td>
</tr>
<tr>
<td><code>javax.xml.ws.WebServiceException</code></td>
</tr>
<tr>
<td><code>java.util.concurrent.ExecutionException</code></td>
</tr>
</tbody>
</table>
This chapter describes how to send SOAP messages as attachments to optimize transmission for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 20.1, "Optimizing Binary Data Transmission Optimization Using MTOM/XOP"
- Section 20.2, "Streaming SOAP Attachments"
- Section 20.3, "Sending SOAP Messages With Attachments Using swaRef"

20.1 Optimizing Binary Data Transmission Optimization Using MTOM/XOP

SOAP Message Transmission Optimization Mechanism/XML-binary Optimized Packaging (MTOM/XOP) defines a method for optimizing the transmission of XML data of type `xs:base64Binary` or `xs:hexBinary` in SOAP messages. When the transport protocol is HTTP, Multipurpose Internet Mail Extension (MIME) attachments are used to carry that data while at the same time allowing both the sender and the receiver direct access to the XML data in the SOAP message without having to be aware that any MIME artifacts were used to marshal the `base64Binary` or `hexBinary` data.

The binary data optimization process involves the following steps:

1. Encode the binary data.
2. Remove the binary data from the SOAP envelope.
3. Compress the binary data.
4. Attach the binary data to the MIME package.
5. Add references to the MIME package in the SOAP envelope.

MTOM/XOP support is standard in JAX-WS via the use of JWS annotations. The MTOM specification does not require that, when MTOM is enabled, the web service runtime use XOP binary optimization when transmitting `base64binary` or `hexBinary` data. Rather, the specification allows the runtime to choose to do so. This is because in certain cases the runtime may decide that it is more efficient to send the binary data directly in the SOAP Message; an example of such a case is when transporting small amounts of data in which the overhead of conversion and transport consumes more resources than just inlining the data as is.
The following Java types are mapped to the base64Binary XML data type, by default: javax.activation.DataHandler, java.awt.Image, and javax.xml.transform.Source. The elements of type base64Binary or hexBinary are mapped to byte[], by default.

The following table summarizes the steps required to use MTOM/XOP to send base64Binary or hexBinary attachments.

<table>
<thead>
<tr>
<th>Table 20–1</th>
<th>Steps to Use MTOM/XOP to Send Binary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Step</td>
</tr>
<tr>
<td>1</td>
<td>Annotate the data types that you are going to use as an MTOM attachment. (Optional)</td>
</tr>
<tr>
<td>2</td>
<td>Enable MTOM on the web service.</td>
</tr>
<tr>
<td>3</td>
<td>Enable MTOM on the client of the web service.</td>
</tr>
<tr>
<td>4</td>
<td>Set the attachment threshold.</td>
</tr>
<tr>
<td>5</td>
<td>(Optional) Enable HTTP chunking.</td>
</tr>
</tbody>
</table>

For more information see:
- MTOM specification at [http://www.w3.org/TR/soap12-mtom](http://www.w3.org/TR/soap12-mtom)
- XOP specification at [http://www.w3.org/TR/xop10](http://www.w3.org/TR/xop10)

### 20.1.1 Annotating the Data Types

Depending on your programming model, you can annotate your Java class or WSDL to define the MIME content types that are used for sending binary data. This step is optional.

The following table defines the mapping of MIME content types to Java types. In some cases, a default MIME type-to-Java type mapping exists. If no default exists, the MIME content types are mapped to DataHandler.

<table>
<thead>
<tr>
<th>Table 20–2</th>
<th>Mapping of MIME Content Types to Java Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIME Content Type</td>
<td>Java Type</td>
</tr>
<tr>
<td>image/gif</td>
<td>java.awt.Image</td>
</tr>
<tr>
<td>image/jpeg</td>
<td>java.awt.Image</td>
</tr>
<tr>
<td>text/plain</td>
<td>java.lang.String</td>
</tr>
<tr>
<td>text/xml or application/xml</td>
<td>javax.xml.transform.Source</td>
</tr>
<tr>
<td><em>/</em></td>
<td>javax.activation.DataHandler</td>
</tr>
</tbody>
</table>

The following sections describe how to annotate the data types based on whether you are starting from Java or WSDL.
20.1.1 Annotating the Data Types: Start From Java

When starting from Java, to define the content types that are used for sending binary data, annotate the field that holds the binary data using the `@XmlMimeType` annotation. The field that contains the binary data must be of type `DataHandler`.

The following example shows how to annotate a field in the Java class that holds the binary data.

```java
@WebMethod
@Oneway
public void dataUpload(
    @XmlMimeType("application/octet-stream") DataHandler data)
{
}
```

20.1.1.2 Annotating the Data Types: Start From WSDL

When starting from WSDL, to define the content types that are used for sending binary data, annotate the WSDL element of type `xs:base64Binary` or `xs:hexBinary` using one of the following attributes:

- `xmime:contentType` - Defines the content type of the element.
- `xmime:expectedContentType` - Defines the range of media types that are acceptable for the binary data.

The following example maps the `image` element of type `base64binary` to `image/gif` MIME type (which maps to the `java.awt.Image` Java type).

```xml
<element name="image" type="base64Binary"
    xmime:expectedContentTypes="image/gif"
    xmlns:xmime="http://www.w3.org/2005/05/xmime"/>
```

20.1.2 Enabling MTOM on the Web Service

You can enable MTOM on the web service using an annotation or WS-Policy file, as described in the following sections:

- **Enabling MTOM on the Web Service Using Annotation**
- **Enabling MTOM on the Web Services by Attaching a WS-Policy File**

20.1.2.1 Enabling MTOM on the Web Service Using Annotation

To enable MTOM in the web service, specify the `@java.xml.ws.soap.MTOM` annotation on the service endpoint implementation class, as illustrated in the following example. Relevant code is shown in bold.

```java
package examples.webservices.mtom;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.xml.ws.soap.MTOM;

@MTOM
@WebService(name="MtomPortType",
    serviceName="MtomService",
    targetNamespace="http://example.org")
```
public class MTOMImpl {
    @WebMethod
    public String echoBinaryAsString(byte[] bytes) {
        return new String(bytes);
    }
}

20.1.2.2 Enabling MTOM on the Web Services by Attaching a WS-Policy File

In addition to the @MTOM annotation, described in the previous section, support for MTOM/XOP in WebLogic JAX-WS web services is implemented using the pre-packaged WS-Policy file Mtom.xml. WS-Policy files follow the WS-Policy specification, described at http://www.w3.org/TR/ws-policy; this specification provides a general purpose model and XML syntax to describe and communicate the policies of a web service, in this case the use of MTOM/XOP to send binary data. The installation of the pre-packaged Mtom.xml WS-Policy file in the types section of the web service WSDL is as follows (provided for your information only; you cannot change this file):

```
<wsp:Policy wsu:Id="myService_policy">
    <wsp:ExactlyOne>
        <wsp:All>
            <wsoma:OptimizedMimeSerialization
            />
        </wsp:All>
    </wsp:ExactlyOne>
</wsp:Policy>
```

When you deploy the compiled JWS file to WebLogic Server, the dynamic WSDL will automatically contain the following snippet that references the MTOM WS-Policy file; the snippet indicates that the web service uses MTOM/XOP:

```
<wsdl:binding name="BasicHttpBinding_IMtomTest"
    type="i0:IMtomTest">
    <wsp:PolicyReference URI="#myService_policy" />
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http" />
</wsdl:binding>
```

You can associate the Mtom.xml WS-Policy file with a web service at development-time by specifying the @Policy metadata annotation in your JWS file. Be sure you also specify the attachToWsdl=true attribute to ensure that the dynamic WSDL includes the required reference to the Mtom.xml file; see the example below.

You can associate the Mtom.xml WS-Policy file with a web service at deployment time by modifying the WSDL to add the Policy to the types section just before deployment.

In addition, you can attach the file at runtime using by the WebLogic Server Administration Console; for details, see “Attach a WS-Policy file to a web service” in the Oracle WebLogic Server Administration Console Online Help. This section describes how to use the JWS annotation.

The following simple JWS file example shows how to use the @weblogic.jws.Policy annotation in your JWS file to specify that the pre-packaged Mtom.xml file should be applied to your web service (relevant code shown in bold):

```
package examples.webservices.mtom;
import javax.jws.WebMethod;
import javax.jws.WebService;
import weblogic.jws.Policy;
```
Optimizing Binary Data Transmission Optimization Using MTOM/XOP

20.1.3 Enabling MTOM on the Client

To enable MTOM on the client of the web service, pass an instance of the `javax.xml.ws.soap.MTOMFeature` as a parameter when creating the web service proxy or dispatch, as illustrated in the following example. Relevant code is shown in **bold**.

```java
package examples.webservices.mtom.client;
import javax.xml.ws.soap.MTOMFeature;
public class Main {
    public static void main(String[] args) {
        String FOO = "FOO";
        MtomService service = new MtomService();
        MtomPortType port = service.getMtomPortTypePort(new MTOMFeature());
        String result = null;
        result = port.echoBinaryAsString(FOO.getBytes());
        System.out.println( "Got result: " + result );
    }
}
```

20.1.4 Setting the Attachment Threshold

You can set the attachment threshold to specify when the `xs:binary64` data is sent inline or as an attachment. By default, the attachment threshold is 0 bytes. All `xs:binary64` data is sent as an attachment.

To set the attachment threshold:

- On the web service, pass the `threshold` attribute to the `@java.xml.ws.soap.MTOM` annotation. For example:
  ```java
  @MTOM(threshold=3072)
  ```

- On the client of the web service, pass the threshold value to `javax.xml.ws.soap.MTOMFeature`. For example:
  ```java
  MtomPortType port = service.getMtomPortTypePort(new MTOMFeature(3072));
  ```

In each of the examples above, if a message is greater than or equal to 3 KB, it will be sent as an attachment. Otherwise, the content will be sent inline, as part of the SOAP message body.

20.1.5 Enabling HTTP Chunking

You can minimize excessive buffering on the client side when processing MTOM attachments by enabling HTTP chunking on the transport layer using one of the following methods:
Set the jaxws.transport.streaming system property to true. In this case, no code modifications are required.


It is recommended that you enable HTTP chunking for CPU-intensive applications that are running on a WebLogic Server instance that is participating in web services interactions as a client and is sending out large messages.

The following excerpt from an Ant build script shows an example of setting the system property when invoking a client application called clients.InvokeMTOMService:

```xml
<target name="run-client">
  <java fork="true"
       classname="clients.InvokeMTOMService"
       failonerror="true">
    <classpath refid="client.class.path"/>
    <arg line="${http-endpoint}"/>
    <jvmarg line="-Djaxws.transport.streaming=true"/>
  </java>
</target>
```

The following code excerpt shows how to set the HTTP_CLIENT_STREAMING_CHUNK_SIZE property.

```java
package examples.webservices.mtomstreaming.client;

import java.util.Map;
import javax.xml.ws.BindingProvider;
import com.sun.xml.ws.developer.JAXWSProperties;
...

public class Main {
  public static void main(String[] args) {
    ...
    Map<String, Object> ctxt=((BindingProvider)port).getRequestContext();
    ctxt.put(JAXWSProperties.HTTP_CLIENT_STREAMING_CHUNK_SIZE, 8192);
    ...
  }
}
```

## 20.2 Streaming SOAP Attachments

**Note:** The com.sun.xml.ws.developer.StreamingDataHandler API is supported as an extension to the JAX-WS RI. Because this API is not provided as part of the WebLogic software, it is subject to change.

Using MTOM and the javax.activation.DataHandler and com.sun.xml.ws.developer.StreamingDataHandler APIs you can specify that a web service use a streaming API when reading inbound SOAP messages that include attachments, rather than the default behavior in which the service reads the entire
message into memory. This feature increases the performance of web services whose SOAP messages are particularly large.

**Note:** Streaming MTOM cannot be used in conjunction with message encryption.

The following sections describe how to employ streaming SOAP attachments on the client and server sides.

### 20.2.1 Client Side Example

The following provides an example that employs streaming SOAP attachments on the client side.

```java
package examples.webservices.mtomstreaming.client;

import java.util.Map;
import java.io.InputStream;
import javax.xml.ws.soap.MTOMFeature;
import javax.activation.DataHandler;
import javax.xml.ws.BindingProvider;
import com.sun.xml.ws.developer.JAXWSProperties;
import com.sun.xml.ws.developer.StreamingDataHandler;

public class Main {
    public static void main(String[] args) {
        MtomStreamingService service = new MtomStreamingService();
        MTOMFeature feature = new MTOMFeature();
        MtomStreamingPortType port = service.getMtomStreamingPortTypePort(feature);
        Map<String, Object> ctxt=((BindingProvider)port).getRequestContext();
        ctxt.put(JAXWSProperties.HTTP_CLIENT_STREAMING_CHUNK_SIZE, 8192);
        DataHandler dh = new DataHandler(new FileDataSource("/tmp/example.jar"));
        port.fileUpload("/tmp/tmp.jar",dh);
        DataHandler dhn = port.fileDownload("/tmp/tmp.jar");
        StreamingDataHandler sdh = (StreamingDataHandler)dhn;
        try{
            File file = new File("/tmp/tmp.jar");
            sdh.moveTo(file);
            sdh.close();
        } catch(Exception e){
            e.printStackTrace();
        }
    }
}
```

The preceding example demonstrates the following:

- To enable MTOM on the client of the web service, pass an instance of the `javax.xml.ws.soap.MTOMFeature` as a parameter when creating the web service proxy or dispatch.
- Configure HTTP streaming support by enabling HTTP chunking on the MTOM streaming client. For more information, see “Enabling HTTP Chunking” on page 20-5.
Map<String, Object> ctxt = ((BindingProvider)port).getRequestContext();
ctxt.put(JAXWSProperties.HTTP_CLIENT_STREAMING_CHUNK_SIZE, 8192);

- Call the port.fileUpload method.
- Cast the DataHandler to StreamingDataHandler and use the StreamingDataHandler.readOnce() method to read the attachment.

### 20.2.2 Server Side Example

The following provides an example that employs streaming SOAP attachments on the server side.

```java
package examples.webservices.mtomstreaming;

import java.io.File;
import java.io.InputStream;
import java.net.MalformedURLException;
import java.net.URL;
import javax.jws.Oneway;
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.xml.bind.annotation.XmlMimeType;
import javax.xml.ws.WebServiceException;
import javax.xml.ws.soap.MTOM;
import com.sun.xml.ws.developer.StreamingAttachment;
import com.sun.xml.ws.developer.StreamingDataHandler;

@WebService(name="MtomStreaming",
serviceName="MtomStreamingService",
targetNamespace="http://example.org",
wsdlLocation="StreamingImplService.wsdl")
@MTOM
public class StreamingImpl {

// Use @XmlMimeType to map to DataHandler on the client side
public void fileUpload(String fileName,
        @XmlMimeType("application/octet-stream")
        DataHandler data) {
    try {
        StreamingDataHandler dh = (StreamingDataHandler) data;
        File file = new File(fileName);
        dh.moveTo(file);
        dh.close();
    } catch (Exception e) {
        throw new WebServiceException(e);
    }

    @XmlMimeType("application/octet-stream")
    @WebMethod
    public DataHandler fileDownload(String filename) {
        return new DataHandler(new FileDataSource(filename));
    }
}
```

The preceding example demonstrates the following:
The @StreamingAttachment annotation is used to configure the streaming SOAP attachment. For more information, see “Configuring Streaming SOAP Attachments” on page 20-9.

The @XmlMimeType annotation is used to map the DataHandler, as follows:

- If starting from WSDL, it is used to map the `xmime:expectedContentTypes="application/octet-stream"` to DataHandler in the generated SEI.
- If starting from Java, it is used to generate an appropriate schema type in the generated WSDL.

Cast the DataHandler to StreamingDataHandler and use the `StreamingDataHandler.moveTo(File)` method to store the contents of the attachment to a file.

### 20.2.3 Configuring Streaming SOAP Attachments

You can configure streaming SOAP attachments on the client and server sides to specify the following:

- Directory in which large attachments are stored.
- Whether to parse eagerly the streaming attachments.
- Maximum attachment size (bytes) that can be stored in memory. Attachments that exceed the specified number of bytes are written to a file.

#### 20.2.3.1 Configuring Streaming SOAP Attachments on the Server

Note: The `com.sun.xml.ws.developer.StreamingAttachment` API is supported as an extension to the JDK 6.0. Because this API is not provided as part of the JDK 6.0 kit, it is subject to change.

To configure streaming SOAP attachments on the server, add the `@StreamingAttachment` annotation on the endpoint implementation. The following example specifies that streaming attachments are to be parsed eagerly (read or write the complete attachment) and sets the memory threshold to 4MB. Attachments under 4MB are stored in memory.

```java
import com.sun.xml.ws.developer.StreamingAttachment;
import javax.jws.WebService;

@StreamingAttachment(parseEagerly=true, memoryThreshold=4000000L)
@WebService(name="HelloWorldPortType", serviceName="HelloWorldService")
public class StreamingImpl {
}
```

#### 20.2.3.2 Configuring Streaming SOAP Attachments on the Client

Note: The `com.sun.xml.ws.developer.StreamingAttachmentFeature` API is supported as an extension to the JDK 6.0. Because this API is not provided as part of the JDK 6.0 kit, it is subject to change.
To configure streaming SOAP attachments on the client, create a `StreamingAttachmentFeature` object and pass this as an argument when creating the `PortType` stub implementation. The following example sets the directory in which large attachments are stored to `/tmp`, specifies that streaming attachments are to be parsed eagerly and sets the memory threshold to 4MB. Attachments under 4MB are stored in memory.

```java
import com.sun.xml.ws.developer.StreamingAttachmentFeature;
...
MTOMFeature mtom = new MTOMFeature();
StreamingAttachmentFeature stf = new StreamingAttachmentFeature("/tmp", true, 4000000L);
MtomStreamingService service = new MtomStreamingService();
MtomStreamingPortType port = service.getMtomStreamingPortTypePort(
    mtom, stf);
...
```

## 20.3 Sending SOAP Messages With Attachments Using swaRef

Together, the specifications defined in Table 20–3 define a mechanism for sending SOAP messages with attachments using the `swaRef` XML attachment type.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOAP With Attachments (SwA)</td>
<td>Defines a MIME multipart/related structure for packaging attachments with SOAP messages. For more information, see <a href="http://www.w3.org/TR/SOAP-attachments">http://www.w3.org/TR/SOAP-attachments</a></td>
</tr>
<tr>
<td>WS-I Attachments Profile</td>
<td>Defines the <code>swaRef</code> schema type that can be used in the WSDL description to represent a reference to an attachment as a content-ID (CID) URL. WS-I publishes a public schema which defines the <code>swaRef</code> type, as defined by the following XSD: <a href="http://ws-i.org/profiles/basic/1.1/xsd/swaref.xsd">http://ws-i.org/profiles/basic/1.1/xsd/swaref.xsd</a> JAXB maps the <code>swaRef</code> schema type to <code>javax.activation.DataHandler</code>. For more information, see: <a href="http://www.ws-i.org/Profiles/AttachmentsProfile-1.0-2004-08-24.html">http://www.ws-i.org/Profiles/AttachmentsProfile-1.0-2004-08-24.html</a></td>
</tr>
</tbody>
</table>

The following shows an example of how to use `swaRef` in a WSDL file to specify that the `claimForm` request and response messages be passed as an attachment.

```xml
<?xml version="1.0" encoding="utf-8"?>
<wsdl:definitions name="SOAPBuilders-mime-cr-test"
    xmlns:types="http://example.org/mime/data"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
    xmlns:tns="http://example.org/mime"
    xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
    targetNamespace="http://example.org/mime">
    <wsdl:types>
        <schema
            xmlns="http://www.w3.org/2001/XMLSchema"
            targetNamespace="http://example.org/mime/data"
            xmlns:xmime="http://www.w3.org/2005/05/xmime"
            elementFormDefault="qualified"
            xmlns:ref="http://ws-i.org/profiles/basic/1.1/xsd"/>
    </wsdl:types>
</wsdl:definitions>
```
As specified in the WSDL example in Example 20–1, the XML content that is tagged as type swaRef is sent as a MIME attachment and the element inside the SOAP body holds the reference to this attachment, as shown in Example 20–2.

Example 20–2  Example of SOAP Message with MIME Attachment

```
Content-Type: Multipart/Related; start-info="text/xml"; type="application/xop+xml";
boundary="-----s_Part_4_3254244.1118953563492"Content-Length: 1193SOAPAction: "
------=Part_5_32550604.1118953563502Content-Type: application/xop+xml; type="text/xml";
charset=utf-8
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <request xmlns="http://example.org/mtom/data">
      cid:b0a597fd-5ef7-4f0c-9d85-6666239f1d25@example.jaxws.sun.com
    </request>
  </soapenv:Body>
</soapenv:Envelope>
<soapenv:Body>
  <request xmlns="http://example.org/mtom/data">
    cid:b0a597fd-5ef7-4f0c-9d85-6666239f1d25@example.jaxws.sun.com
  </request>
</soapenv:Body>
<soapenv:Body>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <request xmlns="http://example.org/mtom/data">
      cid:b0a597fd-5ef7-4f0c-9d85-6666239f1d25@example.jaxws.sun.com
    </request>
  </soapenv:Body>
</soapenv:Envelope>
```

```
<?xml version='1.0' encoding='UTF-8'?><application xmlns="http://java.sun.com/xml/ns/j2ee"```
Example 20–3 shows a sample web service that defines the claimForm operation. As defined in the WSDL, the request and response messages are sent as MIME attachments.

Example 20–3  Example Web Service

```java
package mime.server;
import javax.jws.WebService;
import javax.xml.ws.Holder;
import javax.xml.transform.Source;
import javax.xml.transform.stream.StreamSource;
import javax.activation.DataHandler;
import java.awt.*;
import java.io.ByteArrayInputStream;

@WebService (endpointInterface = "mime.server.Hello")
public class HelloImpl {
    ...
    public ClaimFormTypeResponse claimForm(ClaimFormTypeRequest data){
        ClaimFormTypeResponse resp = new ClaimFormTypeResponse();
        resp.setResponse(data.getRequest());
        return resp;
    }
    ...
}
```

Example 20–4 shows a sample web service client that calls the claimForm operation. Note that the client request data that will be transmitted as an attachment is mapped to the DataHandler data type.

Example 20–4  Example Web Service Client With MIME Attachments

```java
package mime.client;
import javax.xml.transform.stream.StreamSource;
import javax.xml.transform.Source;
import javax.activation.DataHandler;
import java.io.ByteArrayInputStream;
import java.awt.*;

public class MimeApp {
    public static void main (String[] args){
        try {
            Object port = new HelloService().getHelloPort ();
            testSwaref ((Hello)port);
        }
        ...
    }
```
private static void testSwaref (Hello port) throws Exception{
    DataHandler claimForm = new DataHandler (new StreamSource(
        new ByteArrayInputStream(sampleXML.getBytes())), "text/xml");
    ClaimFormTypeRequest req = new ClaimFormTypeRequest();
    req.setRequest(claimForm);
    ClaimFormTypeResponse resp = port.claimForm (req);
    DataHandler out = resp.getResponse();
    ...
}

private static final String sampleXML = "<?xml version="1.0" encoding="UTF-8" ?>
" +
    "<NMEAstd>
" +
    "<DevIdSentenceId>$GPRMC</DevIdSentenceId>
" +
    "<Time>212949</Time>
" +
    "<Navigation>A</Navigation>
" +
    "<NorthOrSouth>4915.61N</NorthOrSouth>
" +
    "<WestOrEast>12310.55W</WestOrEast>
" +
    "<SpeedOnGround>000.0</SpeedOnGround>
" +
    "<Course>360.0</Course>
" +
    "<Date>030904</Date>
" +
    "<MagneticVariation>020.3</MagneticVariation>
" +
    "<MagneticPoleEastOrWest>E</MagneticPoleEastOrWest>
" +
    "<ChecksumInHex>*6B</ChecksumInHex>
" +
    "</NMEAstd>";
Managing Web Service Persistence

This chapter describes how to manage persistence for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 21.1, "Overview of Web Service Persistence"
- Section 21.2, "Roadmap for Configuring Web Service Persistence"
- Section 21.3, "Configuring Web Service Persistence"
- Section 21.4, "Using Web Service Persistence in a Cluster"
- Section 21.5, "Cleaning Up Web Service Persistence"

21.1 Overview of Web Service Persistence

WebLogic Server provides a default web service persistence configuration that provides a built-in, high-performance storage solution for web services. Web service persistence is used by the following advanced features to support long running requests and to survive server restarts:

- Asynchronous web service invocation using asynchronous client transport or Make Connection
- Web services reliable messaging
- Message buffering
- Security using WS-SecureConversation

Specifically, web service persistence is used to save the following types of information:

- Client identity and properties
- SOAP message, including its headers and body
- Context properties required for processing the message at the web service or client (for both asynchronous and synchronous messages)

The following figure illustrates an example web service persistence configuration.
The following table describes the components of web service persistence, shown in the previous figure.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical Store</td>
<td>Provides the configuration requirements and connects the web service to the physical store and buffering queue.</td>
</tr>
<tr>
<td>Physical Store</td>
<td>Handles the I/O operations to save and retrieve data from the physical storage (such as file, DBMS, and so on). The physical store can be a WebLogic Server persistent store, as configured using the WebLogic Server Administration Console or WLST, or in-memory store. <strong>Note</strong>: When using a WebLogic Server persistent store as the physical store for a logical store, the names of the request and response buffering queues are taken from the logical store configuration and not the buffering configuration.</td>
</tr>
<tr>
<td>Buffering queue</td>
<td>Stores buffered requests and responses for the web service.</td>
</tr>
</tbody>
</table>

When configuring web service persistence, you associate:

- A logical store with a buffering queue.
- A buffering queue that is associated with a physical store via JMS configuration.

The association between the logical store and buffering queue is used to infer the association between the logical store and physical store. The default logical store is named WseeStore and is created automatically when a domain is created using the WebLogic Advanced Web Services for JAX-WS Extension template (wls_webservice_jaxws.jar). By default, the physical store that is configured for the server is associated with the buffering queue. This strategy ensures that the same physical store is used for all web service persistence and buffering. Using a single physical store ensures a more efficient, single-phase XA transaction and facilitates migration.

You can configure one or more logical stores for use within your application environment. In Table 21–1, the servers Server1 and Server2 use the same logical store. This configuration allows applications that are running in a cluster to be configured globally to access a single store name. As described later in Section 21.3, "Configuring Web Service Persistence", you can configure web service persistence at various levels for fine-grained management. Best practices are provided in Section 21.2, "Roadmap for Configuring Web Service Persistence."
21.2 Roadmap for Configuring Web Service Persistence

Table 21–2 provides best practices for configuring web service persistence to support web service reliable messaging.

<table>
<thead>
<tr>
<th>Best Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define a logical store for each administrative unit (for example, business unit, department, and so on).</td>
<td>By defining separate logical stores, you can better manage the service-level agreements for each administrative unit. For more information, see Section 21.3.1, “Configuring the Logical Store.”</td>
</tr>
<tr>
<td>Use the correct logical store for each client or service related to the administrative unit.</td>
<td>You can configure the logical store at the WebLogic Server, web service, or web service client level. For more information, see Section 21.3, “Configuring Web Service Persistence.”</td>
</tr>
<tr>
<td>Define separate physical stores and buffering queues for each logical store.</td>
<td>For more information, see Section 21–1, “Example Web Service Persistence Configuration.”</td>
</tr>
</tbody>
</table>

The best practices defined in Table 21–2 facilitates maintenance, and failure recovery and resource migration.

For example, assume Company X is developing web services for several departments, including manufacturing, accounts payable, and accounts receivable. Following best practices, Company X defines a minimum of three logical stores, one for each department.

Furthermore, assume that the manufacturing department has a service-level agreement with the IT department that specifies that it can tolerate system outages that are no longer than a few minutes in duration. The accounts payable and receivable departments, on the other hand, have a more relaxed service-level agreement, tolerating system outages up to one hour in duration. If the systems that host web services and clients for the manufacturing department become unavailable, the IT department is responsible for ensuring that any resources required by those web services and clients are migrated to new active servers within minutes of the failure. Because separate logical stores were defined, the IT department can migrate the file store, JMS servers, and so on, associated with the manufacturing department logical store independently of the resources required for accounts payables and receivables.

21.3 Configuring Web Service Persistence

The following table summarizes the information that you can configure for each of the web service persistence components.
Configuring Web Service Persistence

Table 21–3  Summary of the Web Service Persistence Component Configuration

<table>
<thead>
<tr>
<th>Component</th>
<th>Summary of Configuration Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical Store</td>
<td>You configure the following information for each logical store:</td>
</tr>
<tr>
<td></td>
<td>■ Name of the logical store.</td>
</tr>
<tr>
<td></td>
<td>■ Maximum lifetime of an object in the store.</td>
</tr>
<tr>
<td></td>
<td>■ The cleaner thread that removes stale objects from the store. For more information, see Section 21.5,</td>
</tr>
<tr>
<td></td>
<td>&quot;Cleaning Up Web Service Persistence&quot;.</td>
</tr>
<tr>
<td></td>
<td>■ Accessibility from other servers in a network.</td>
</tr>
<tr>
<td></td>
<td>■ Request and response buffering queues. The request buffering queue is used to infer the physical</td>
</tr>
<tr>
<td></td>
<td>store by association.</td>
</tr>
<tr>
<td>Physical store</td>
<td>You configure the following information for the physical store:</td>
</tr>
<tr>
<td></td>
<td>■ Name of the physical store.</td>
</tr>
<tr>
<td></td>
<td>■ Type and performance parameters.</td>
</tr>
<tr>
<td></td>
<td>■ Location of the store.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> You configure the physical store or buffering queue, but not both. If the buffering queue</td>
</tr>
<tr>
<td></td>
<td>is configured, then the physical store information is inferred.</td>
</tr>
<tr>
<td>Buffering queue</td>
<td>You configure the following information for the buffering queue:</td>
</tr>
<tr>
<td></td>
<td>■ Request and response queue details</td>
</tr>
<tr>
<td></td>
<td>■ Retry counts and delays</td>
</tr>
</tbody>
</table>

You can configure web service persistence at the levels defined in the following table.

Table 21–4  Configuring Web Service Persistence

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebLogic Server</td>
<td>The web service persistence configured at the server level defines the default configuration for all web services and clients running on that server.</td>
</tr>
<tr>
<td></td>
<td>When creating or extending a domain using Configuration Wizard, you can apply the WebLogic Advanced Web Services for JAX-WS Extension template</td>
</tr>
<tr>
<td></td>
<td>(wls_webservice_jaxws.jar) to configure automatically the resources required to support web services persistence.</td>
</tr>
<tr>
<td></td>
<td>Although use of this extension template is not required, it makes the configuration of the required resources much easier.</td>
</tr>
<tr>
<td></td>
<td>■ Configure the resources required for web service persistence using the Oracle WebLogic Server Administration Console or WLST. For more</td>
</tr>
<tr>
<td></td>
<td>information, see:</td>
</tr>
<tr>
<td></td>
<td>- WebLogic Server Administration Console: &quot;Configure web service persistence&quot; in Oracle WebLogic Server Administration Console Online Help</td>
</tr>
<tr>
<td></td>
<td>- WLST: &quot;Configuring Existing Domains&quot; in Understanding the WebLogic Scripting Tool</td>
</tr>
<tr>
<td></td>
<td>For more information, see Section 3.2, &quot;Configuring Your Domain For Advanced Web Services Features.&quot;</td>
</tr>
<tr>
<td>Web service endpoint</td>
<td>Configure the default logical store used by the web service endpoint, as described in Section 21.3.2, &quot;Configuring Web Service Persistence for a</td>
</tr>
<tr>
<td></td>
<td>Web Service Endpoint.&quot;</td>
</tr>
<tr>
<td>Web service client</td>
<td>Configure the default logical store used by the web service client, as described in Section 21.3.3, &quot;Configuring Web Service Persistence for Web</td>
</tr>
<tr>
<td></td>
<td>Service Clients.&quot;</td>
</tr>
</tbody>
</table>

The following sections provide more information about configuring web service persistence:

■ Section 21.3.1, "Configuring the Logical Store"
21.3.1 Configuring the Logical Store

You can configure one or more logical stores for use within your application environment, and identify the logical store that is used as the default.

The default logical store, `WseeStore`, is generated automatically when you create or extend a domain using the WebLogic Advanced Web Services for JAX-WS Extension template (`wls_webservice_jaxws.jar`), as described in Section 3.2, "Configuring Your Domain For Advanced Web Services Features."

You can configure the logical store using the WebLogic Server Administration Console, see “Configure web service persistence” in Oracle WebLogic Server Administration Console Online Help. Alternatively, you can use WLST to configure the resources. For information about using WLST to extend the domain, see “Configuring Existing Domains” in Understanding the WebLogic Scripting Tool.

The following table summarizes the properties that you define for the logical store.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Logical Store Name</td>
<td>Name of the logical store. The name must begin with an alphabetical character and can contain alphabetical characters, spaces, dashes, underscores, and numbers only. This field defaults to <code>LogicalStore_n</code>. This field is required. If you create or extend a single server domain using the web service extension template, a logical store named <code>WseeStore</code> is created by default.</td>
</tr>
<tr>
<td>Default Logical Store</td>
<td>Flag that specifies whether the logical store is used, by default, to persist state of all web services on the server. Only one logical store can be set as the default. If you enable this flag on the current logical store, the flag is disabled on the current default store.</td>
</tr>
<tr>
<td>Persistence strategy</td>
<td>Persistence strategy. Select one of the following values from the drop-down menu.</td>
</tr>
<tr>
<td></td>
<td>LOCAL ACCESS ONLY—Accessible to the local server only.</td>
</tr>
<tr>
<td></td>
<td>IN MEMORY—Accessible by the local VM only. In this case, the buffering queue and physical store configuration information is ignored.</td>
</tr>
<tr>
<td>Request Buffering Queue JNDI Name</td>
<td>JNDI name for the request buffering queue. The request buffering queue is used to infer the physical store by association. If this property is not set, then the default physical store that is configured for the server is used. <strong>Note:</strong> You configure the physical store or buffering queue, but not both. If the buffering queue is configured, then the physical store information is inferred. It is recommended that the same physical storage resource be used for both persistent state and message buffering to allow for a more efficient, single-phase XA transaction and facilitate service migration. By setting this value, you ensure that the buffering queue and physical store reference the same physical storage resource. If you create or extend a domain using the web service extension template, a buffering queue named <code>weblogic.wsee.BufferedRequestQueue</code> is created by default. <strong>Note:</strong> This property is ignored if Persistence strategy is set to In Memory.</td>
</tr>
</tbody>
</table>
Developing JAX-WS Web Services for Oracle WebLogic Server

21.3.2 Configuring Web Service Persistence for a Web Service Endpoint

By default, web service endpoints use the web service persistent store defined for the server. You can override the logical store used by the web service endpoint using the WebLogic Server Administration Console. For more information, see "Configure web service persistence" in Oracle WebLogic Server Administration Console Online Help.

21.3.3 Configuring Web Service Persistence for Web Service Clients

For information about configuring persistence for web service clients, see Section 8.5, "Configuring Web Service Clients."

21.4 Using Web Service Persistence in a Cluster

The following provides some considerations for using web services persistence in a cluster:

- If you create or extend a clustered domain using the WebLogic Advanced Web Services for JAX-WS Extension template (wls_webservice_jaxws.jar), the resources required to support web services persistence in a cluster are automatically created. For more information, see Section 3.2, "Configuring Your Domain For Advanced Web Services Features."

- To facilitate service migration, it is recommended that the same physical storage resource be used for both persistent state and message buffering. To ensure that the buffering queue and physical store reference the same physical storage resource, you configure the Request Buffering Queue JNDI Name property of the

---

**Table 21–5 (Cont.) Configuration Properties for the Logical Store**

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Buffering Queue JNDI Name</td>
<td>JNDI name for the response buffering queue.</td>
</tr>
<tr>
<td></td>
<td>If this property is not set, then the request queue is used, as defined by</td>
</tr>
<tr>
<td></td>
<td>the Request Buffering Queue JNDI Name property.</td>
</tr>
<tr>
<td></td>
<td>If you create or extend a domain using the web service extension template,</td>
</tr>
<tr>
<td></td>
<td>a buffering queue named weblogic.wsee.BufferedRequestErrorQueue is created by</td>
</tr>
<tr>
<td></td>
<td>default.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: This property is ignored if Persistence strategy is set to In Memory.</td>
</tr>
<tr>
<td>Cleaner Interval</td>
<td>Interval at which the logical store will be cleaned. For more information,</td>
</tr>
<tr>
<td></td>
<td>see Section 21.5, &quot;Cleaning Up Web Service Persistence&quot;.</td>
</tr>
<tr>
<td></td>
<td>The value specified must be a positive value and conform to the XML schema</td>
</tr>
<tr>
<td></td>
<td>duration lexical format, ( PnYnMnDnTnHnMnSnS ), where ( nY ) specifies</td>
</tr>
<tr>
<td></td>
<td>the number of years, ( nM ) specifies the number of months, ( nD )</td>
</tr>
<tr>
<td></td>
<td>specifies the number of days, ( T ) is the date/time separator, ( nH )</td>
</tr>
<tr>
<td></td>
<td>specifies the number of hours, ( nM ) specifies the number of minutes, and</td>
</tr>
<tr>
<td></td>
<td>( nS ) specifies the number of seconds. This value defaults to PT10M (10</td>
</tr>
<tr>
<td></td>
<td>minutes).</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: This field is available when editing the logical store only. When</td>
</tr>
<tr>
<td></td>
<td>creating the logical store, the field is set to the default, PT10M (10</td>
</tr>
<tr>
<td></td>
<td>minutes).</td>
</tr>
<tr>
<td>Default Maximum Object Lifetime</td>
<td>Default value used as the maximum lifetime of an object. This value can be</td>
</tr>
<tr>
<td></td>
<td>overridden by the individual objects saved to the logical store.</td>
</tr>
<tr>
<td></td>
<td>The value specified must be a positive value and conform to the XML schema</td>
</tr>
<tr>
<td></td>
<td>duration lexical format, ( PnYnMnDnTnHnMnSnS ), where ( nY ) specifies</td>
</tr>
<tr>
<td></td>
<td>the number of years, ( nM ) specifies the number of months, ( nD )</td>
</tr>
<tr>
<td></td>
<td>specifies the number of days, ( T ) is the date/time separator, ( nH )</td>
</tr>
<tr>
<td></td>
<td>specifies the number of hours, ( nM ) specifies the number of minutes, and</td>
</tr>
<tr>
<td></td>
<td>( nS ) specifies the number of seconds. This value defaults to P1D (one day).</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: This field is available when editing the logical store only. When</td>
</tr>
<tr>
<td></td>
<td>creating the logical store, the field is set to the default, P1D (one day).</td>
</tr>
</tbody>
</table>

---

**21.3.2 Configuring Web Service Persistence for a Web Service Endpoint**

By default, web service endpoints use the web service persistent store defined for the server. You can override the logical store used by the web service endpoint using the WebLogic Server Administration Console. For more information, see "Configure web service persistence" in Oracle WebLogic Server Administration Console Online Help.

**21.3.3 Configuring Web Service Persistence for Web Service Clients**

For information about configuring persistence for web service clients, see Section 8.5, "Configuring Web Service Clients."

**21.4 Using Web Service Persistence in a Cluster**

The following provides some considerations for using web services persistence in a cluster:

- If you create or extend a clustered domain using the WebLogic Advanced Web Services for JAX-WS Extension template (wls_webservice_jaxws.jar), the resources required to support web services persistence in a cluster are automatically created. For more information, see Section 3.2, "Configuring Your Domain For Advanced Web Services Features."

- To facilitate service migration, it is recommended that the same physical storage resource be used for both persistent state and message buffering. To ensure that the buffering queue and physical store reference the same physical storage resource, you configure the Request Buffering Queue JNDI Name property of the
logical store, as described in Section 21.3.1, "Configuring the Logical Store".

- It is recommended that the buffering queues be defined as JMS uniform distributed destinations (UDDs). JMS defines a member queue for the UDD on each JMS Server that you identify. Because a logical store is associated with a physical store through the defined buffering queue, during service migration, this allows a logical store to use the new physical stores seamlessly for the member queues that migrate onto the new server.

- It is recommended that you target the JMS Server, store-and-forward (SAF) service agent, and physical store (file store) resources to migrateable targets. For more information, see Section 3.2.1, "Resources Required by Advanced Web Service Features."

For example, consider the two-node cluster configuration shown in Figure 21–2. The domain resources are configured and targeted using the guidelines provided above.

*Figure 21–2  Example of a Two-Node Cluster Configuration (Before Migration)*

The following figure shows how the resources on Server1 can be easily migrated to Server2 in the event Server1 fails.
21.5 Cleaning Up Web Service Persistence

The persisted information is cleaned up periodically to remove expired or stale objects. Typically, an object is associated with a specific expiration time or a maximum lifetime. In addition, a stale object may represent a request for which no response was received or a reliable messaging sequence that was not explicitly terminated.

You configure the interval of time at which web service persistence will be cleaned by setting the **Cleaner Interval** configuration property on the logical store. For more information about setting this property, see Section 21.3.1, "Configuring the Logical Store".
This chapter describes how to configure message buffering for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 22.1, "Overview of Message Buffering"
- Section 22.2, "Configuring Messaging Buffering"

### 22.1 Overview of Message Buffering

When an operation on a buffered web service is invoked, the message representing that invocation is stored in a JMS queue. WebLogic Server processes this buffered message asynchronously. If WebLogic Server goes down while the message is still in the queue, it will be processed as soon as WebLogic Server is restarted.

WebLogic Server then processes the request message on a separate thread obtained from a pre-configured and managed pool of threads. This allows WebLogic Server to absorb spikes in client load, and continue to process the requests in an orderly fashion over a period of time. Message buffering is a powerful tool to avoid denial of service attacks and general overload conditions on the server.

To assist you in determining whether to configure message buffering on the web service, it is recommended that you review Section 14.1.4.4, "Failure Scenarios with Non-buffered Reliable Web Services."

### 22.2 Configuring Messaging Buffering

You can configure message buffering for web services at the WebLogic Server or web service endpoint levels. The message buffering configured at the server level defines the default message buffering defined for all web services and clients running on that server, unless explicitly overridden at the web service endpoint level.

For detailed steps to configure message buffering for web services at the WebLogic Server or web service endpoint level using the WebLogic Server Administration Console, see "Configure message buffering for web services" in Oracle WebLogic Server Administration Console Online Help.

When you configure message buffering at the web service endpoint level, select **Customize Buffering Configuration** to indicate that you want to customize the buffering configuration defined in the web service descriptor or deployment plan at the web service endpoint level. If not checked, the buffering configuration specified at the WebLogic Server level is used.
Alternatively, you can use WLST to configure message buffering. For information about using WLST to extend the domain, see “Configuring Existing Domains” in Understanding the WebLogic Scripting Tool.

The following sections describe message buffering configuration properties:

- Section 22.2.1, "Configuring the Request Queue"
- Section 22.2.2, "Configuring the Response Queue"
- Section 22.2.3, "Configuring Message Retry Count and Delay"

### 22.2.1 Configuring the Request Queue

The following table summarizes the properties used to configure the request queue.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request Queue Enabled</td>
<td>Flag that specifies whether the request queue is enabled. By default, the request queue is disabled. The request queue name is defined by the logical store enabled at this level. When using a WebLogic Server persistent store as the physical store for a logical store, the names of the request and response buffering queues are taken from the logical store configuration and not the buffering configuration.</td>
</tr>
<tr>
<td>Request Queue Connection Factory JNDI Name</td>
<td>JNDI name of the connection factory to use for request message buffering. This value defaults to the default JMS connection factory defined by the server.</td>
</tr>
<tr>
<td>Request Queue Transaction Enabled</td>
<td>Flag that specifies whether transactions should be used when storing and retrieving messages from the request buffering queue. This flag defaults to false.</td>
</tr>
</tbody>
</table>

### 22.2.2 Configuring the Response Queue

The following table summarizes the properties used to configure the response queue.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Queue Enabled</td>
<td>Flag that specifies whether the response queue is enabled. By default, the response queue is disabled. The response queue name is defined by the logical store enabled at this level. When using a WebLogic Server persistent store as the physical store for a logical store, the names of the request and response buffering queues are taken from the logical store configuration and not the buffering configuration.</td>
</tr>
<tr>
<td>Response Queue Connection Factory JNDI Name</td>
<td>JNDI name of the connection factory to use for response message buffering. This value defaults to the default JMS connection factory defined by the server.</td>
</tr>
<tr>
<td>Response Queue Transaction Enabled</td>
<td>Flag that specifies whether transactions should be used when storing and retrieving messages from the response buffering queue. This flag defaults to false.</td>
</tr>
</tbody>
</table>

### 22.2.3 Configuring Message Retry Count and Delay

The following table summarizes the properties used to configure the message retry count and delay.
Table 22–3  Configuring Message Retry Count and Delay

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retry Count</td>
<td>Number of times that the JMS queue on the invoked WebLogic Server instance attempts to deliver the message to the web service implementation until the operation is successfully invoked. This value defaults to 3.</td>
</tr>
<tr>
<td>Retry Delay</td>
<td>Amount of time between retries of a buffered request and response. Note, this value is only applicable when RetryCount is greater than 0.</td>
</tr>
</tbody>
</table>

The value specified must be a positive value and conform to the XML schema duration lexical format, PnYnMnDTnHnMnS, where nY specifies the number of years, nM specifies the number of months, nD specifies the number of days, T is the date/time separator, nH specifies the number of hours, nM specifies the number of minutes, and nS specifies the number of seconds. This value defaults to P0DT30S (30 seconds).
This chapter describes how to manage WebLogic web services in a cluster. This chapter includes the following sections:

- Section 23.1, "Overview of Web Services Cluster Routing"
- Section 23.2, "Cluster Routing Scenarios"
- Section 23.3, "How Web Service Cluster Routing Works"
- Section 23.4, "Configuring Web Services in a Cluster"
- Section 23.5, "Monitoring Cluster Routing Performance"

**Note:** For considerations specific to using web service persistence in a cluster, see Section 21.4, "Using Web Service Persistence in a Cluster."

### 23.1 Overview of Web Services Cluster Routing

Clustering of *stateless* web services—services that do not require knowledge of state information from prior invocations—is straightforward and works with existing WebLogic HTTP routing features on a third-party HTTP load balancer.

Clustering of web services that require state information be maintained provides more challenges. Each instance of such a web service is associated with state information that must be managed and persisted. The cluster routing decision is based on whether the message is bound to a specific server in the cluster. For example, if a particular server stores state information that is needed to process the message, and that state information is available only locally on that server.

**Note:** Services that use session state replication to maintain their state are a separate class of problem from those that make use of advanced web service features, such as Reliable Secure Profile. The latter require a more robust approach to persistence that may include storing state that may be available only from the local server. For more information, see Section , "A Note About Persistence."

In addition to ensuring that the web service requests are routed to the appropriate server, the following general clustering requirements must be satisfied:

- The internal topology of a cluster must be transparent to clients. Clients interact with the cluster only through the front-end host, and do not need to be aware of
any particular server in the cluster. This enables the cluster to scale over time to meet the demands placed upon it.

- Cluster migration must be transparent to clients. Resources within the cluster (including persistent stores and other resources required by a web service or web service client) can be migrated from one server to another as the cluster evolves, responds to failures, and so on.

To meet the above requirements, the following methods are available for routing web services in a cluster:

- **In-place SOAP router**—Assumes request messages arrive on the correct server and, if not, forwards the messages to the correct server ("at most one additional hop"). The routing decision is made by the web service that receives the message. This routing strategy is the simplest to implement and requires no additional configuration. Though, it is not as robust as the next option.

- **Front-end SOAP router** (HTTP cluster servlet only)—Message routing is managed by the front-end host that accepts messages on behalf of the cluster and forwards them onto a selected member server of the cluster. For web services, the front-end SOAP router inspects information in the SOAP message to determine the correct server to which it should route messages.

This routing strategy is more complicated to configure, but is the most efficient since messages are routed directly to the appropriate server (avoiding any "additional hops").

---

**Note:** When using Make Connection, as described in Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)", only front-end SOAP routing can guarantee proper routing of all messages related to a given Make Connection anonymous URI.

---

This chapter describes how to configure your environment to optimize the routing of web services within a cluster. Use of the HTTP cluster servlet for the front-end SOAP router is described. The in-place SOAP router is also enabled and is used in the event the HTTP cluster servlet is not available or has not yet been initialized.

**A Note About Persistence**

While it is possible to maintain state for a web service using the HttpSession as described in Section 31, "Programming Stateful JAX-WS Web Services Using HTTP Session," in some cases this simple persistence may not be robust enough. Advanced web services features like reliable messaging, Make Connection, secure conversation, and so on, have robust persistence requirements that cannot be met by using the HttpSession alone. Advanced web service features use a dedicated persistence implementation based on the concept of a *logical store*. For more information, see Section 21, "Managing Web Service Persistence."

At this time, these two approaches to persistence of web service state are not compatible with each other. If you choose to write a clustered stateful web service using HttpSession persistence and then use the advanced web service features from that service (either as a client or service), Oracle cannot guarantee correct operation of your service in a cluster. This is because HttpSession replication may make the HttpSession available on a different set of servers than are hosting the persistence for advanced web service features.
23.2 Cluster Routing Scenarios

The following sections illustrate several scenarios for routing web service request and response messages within a clustered environment:

- Section 23.2.1, "Scenario 1: Routing a Web Service Response to a Single Server"
- Section 23.2.2, "Scenario 2: Routing Web Service Requests to a Single Server Using Routing Information"
- Section 23.2.3, "Scenario 3: Routing Web Service Requests to a Single Server Using an ID"

23.2.1 Scenario 1: Routing a Web Service Response to a Single Server

In this scenario, an incoming request is load balanced to a server. Any responses to that request must be routed to that same server, which maintains state information on behalf of the original request.

Figure 23–1 Routing a Web Service Response to a Single Server

As shown in the previous figure:

1. The front-end SOAP router routes an incoming HTTP request and sends it to Server2 using standard load balancing techniques.
2. Server2 calls Myservice at the web service endpoint address. The ReplyTo header in the SOAP message contains a pointer back to the front-end SOAP router.
3. MyService returns the response to the front-end SOAP router.
4. The front-end SOAP router must determine where to route the response. Because Server2 maintains state information that is relevant to the response, the front-end SOAP router routes the response to Server2.
23.2.2 Scenario 2: Routing Web Service Requests to a Single Server Using Routing Information

In this scenario, an incoming request is load balanced to a server. The response contains routing information that targets the original server for any subsequent requests.

**Figure 23–2 Routing Web Service Requests to a Single Server**

As shown in the previous figure:

1. The front-end SOAP router routes an incoming HTTP request (Request1) and sends it to Server 2 using standard load balancing techniques. The request has no routing information.

2. Server2 calls the Myservice at the web service endpoint address. The ReplyTo header in the SOAP message contains a pointer back to the front-end SOAP router.

3. MyService returns the response to the caller. The response contains routing information that targets Server2 for any subsequent requests. The caller is responsible for passing the routing information contained in the response in any subsequent requests (for example, Request2).

4. The front-end SOAP router uses the routing information passed with Request2 to route the request to Server2.

23.2.3 Scenario 3: Routing Web Service Requests to a Single Server Using an ID

In this scenario, an incoming SOAP request contains an identifier, but no routing information. All subsequent requests with the same identifier must go to the same server.
How Web Service Cluster Routing Works

Figure 23–3 Routing Web Service Requests to a Single Server Using an ID

As shown in the previous figure:

1. A request comes from a web service client that includes an ID (Make Connection anonymous URI) that will be shared by future requests that are relevant to Request1. The form of this ID is protocol-specific.

2. The front-end SOAP router detects an ID in Request1 and checks the affinity store to determine if the ID is associated with a particular server in the cluster. In this case, there is no association defined.

3. The front-end SOAP router load balances the request and sends it to Server2 for handling.

4. The MyService web service instance on Server2 handles the request (generating a response, if required). Unlike in Section 23.2.2, "Scenario 2: Routing Web Service Requests to a Single Server Using Routing Information", routing information cannot be propagated in this case.

5. Request2 arrives at the front-end SOAP router using the same ID as that used in Request1.

6. The front-end SOAP router detects the ID and checks the affinity store to determine if the ID is associated with a particular server. This time, it determines that the ID is mapped to Server2.

7. Based on the affinity information, the front-end SOAP router routes Request2 to Server2.

23.3 How Web Service Cluster Routing Works

The following sections describe how web service cluster routing works:

- Section 23.3.1, "Adding Routing Information to Outgoing Requests"
- Section 23.3.2, "Detecting Routing Information in Incoming Requests"
- Section 23.3.3, "Routing Requests Within the Cluster"
- Section 23.3.4, "Maintaining the Routing Map on the Front-end SOAP Router"
23.3.1 Adding Routing Information to Outgoing Requests

The web services runtime adds routing information to the SOAP header of any outgoing message to ensure proper routing of messages in the following situations:

- The request is sent from a web service client that uses a store that is not accessible from every member server in the cluster.
- The request requires in-memory state information used to process the response.

When processing an outgoing message, the web services runtime:

- Creates a message ID for the outgoing request, if one has not already been assigned, and stores it in the `RelatesTo/MessageID` SOAP header using the following format:
  
  \[ \text{uuid:WLSformat_version:store_name:uniqueID} \]
  
  Where:
  
  - `format_version` specifies the WebLogic Server format version, for example WLS1.
  - `store_name` specifies the name of the persistent store, which specifies the store in use by the current web service or web service client sending the message. For example, `Server1Store`. This value may be a system-generated name, if the default persistent store is used, or an empty string if no persistent store is configured.
  - `unique_ID` specifies the unique message ID. For example:
    
    68d6fc6f85a3c1cb:-2d3b89ab8:12068ad2e60:-7feb
  
- Allows other web service components to inject routing information into the message before it is sent.

23.3.2 Detecting Routing Information in Incoming Requests

The SOAP router (in-place or front-end) inspects incoming requests for routing information. In particular, the SOAP router looks for a `RelatesTo/MessageID` SOAP header to find the name of the persistent store and routes the message back to the server that hosts that persistent store.

In the event that there is an error in determining the correct server using front-end SOAP routing, then the message is sent to any server within the cluster and the in-place SOAP router is used. If in-place SOAP routing fails, then the sender of the message receives a fault on the protocol-specific back channel.

**Note:** SOAP message headers that contain routing information must be presented in clear text; they cannot be encrypted.

23.3.3 Routing Requests Within the Cluster

To assist in making a routing determination, the SOAP router (in-place or front-end) uses a dynamic map of store-to-server name associations. This dynamic map originates on the Managed Servers within a cluster and is accessed in memory by the in-place SOAP router and via HTTP response headers by the front-end SOAP router. The HTTP response headers are included automatically by WebLogic Server in every HTTP response sent by a web service in the cluster.
Initially, the dynamic map is empty. It is only initialized after receiving its first response back from a Managed Server in the cluster. Until it receives back its first response with the HTTP response headers, the front-end SOAP router simply load balances the requests, and the in-place SOAP router routes the request to the appropriate server.

In the absence of SOAP-based routing information, it defers to the base routing that includes HTTP-session based routing backed by simple load balancing (for example, round-robin).

### 23.3.4 Maintaining the Routing Map on the Front-end SOAP Router

As noted in Section 23.3.3, "Routing Requests Within the Cluster", to assist in making a routing determination, the SOAP router (in-place or front-end) uses a dynamic map of store-to-server name associations.

To generate this dynamic map, two new HTTP response headers are provided, as described in the following sections. These headers are included automatically by WebLogic Server in every HTTP response sent by a web service in the cluster.

#### 23.3.4.1 X-weblogic-wsee-storetoserver-list HTTP Response Header

A complete list of store-to-server mappings is maintained in the
X-weblogic-wsee-storetoserver-list HTTP response header. The front-end SOAP router uses this header to populate a mapping that can be referenced at runtime to route messages.

The X-weblogic-wsee-storetoserver-list HTTP response header has the following format:

storename1:host_server_spec | storename2:host_server_spec | storename3:host_server_spec

In the above:

- **storename** specifies the name of the persistent store.
- **host_server_spec** is specifies using the following format:
  servername:port:sslport. If not known, the **sslport** is set to -1.

#### 23.3.4.2 X-weblogic-wsee-storetoserver-hash HTTP Response Header

A hash mapping of the store-to-server list is provided in
X-weblogic-wsee-storetoserver-hash HTTP response header. This header enables you to determine whether the new mapping list needs to be refreshed.

The X-weblogic-wsee-storetoserver-hash HTTP response header contains a String value representing the hash value of the list contained in the
X-weblogic-wsee-storetoserver-list HTTP response header. By keeping track of the last entry in the list, it can be determined whether the list needs to be refreshed.

23.4 Configuring Web Services in a Cluster

The following table summarizes the steps to configure web services in a cluster.

<table>
<thead>
<tr>
<th>Table 23–1</th>
<th>Steps to Manage Web Services in a Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Step</td>
</tr>
<tr>
<td>1</td>
<td>Set up the WebLogic cluster.</td>
</tr>
<tr>
<td>2</td>
<td>Configure the clustered domain resources required for advanced web service features.</td>
</tr>
<tr>
<td>3</td>
<td>Extend the front-end SOAP router to support web services.</td>
</tr>
<tr>
<td>4</td>
<td>Enable routing of web services atomic transaction messages.</td>
</tr>
<tr>
<td>5</td>
<td>Enable routing of web services Make Connection messages.</td>
</tr>
<tr>
<td>6</td>
<td>Configure the identity of the front-end SOAP router.</td>
</tr>
</tbody>
</table>

23.4.1 Setting Up the WebLogic Cluster

Set up the WebLogic cluster, as described in "Setting up WebLogic Clusters" in Administering Clusters for Oracle WebLogic Server. Please note:

- To configure the clustered domain, see Section 23.4.2, "Configuring the Domain Resources Required for Web Service Advanced Features in a Clustered Environment.".

- To enable SOAP-based front-end SOAP routing, configure an HTTP cluster servlet, as described in "Set Up the HttpClusterServlet" in Administering Clusters for Oracle WebLogic Server.

23.4.2 Configuring the Domain Resources Required for Web Service Advanced Features in a Clustered Environment

When creating or extending a domain using Configuration Wizard, you can apply the WebLogic Advanced Web Services for JAX-WS Extension template (wls_web_service_jaxws.jar) to configure automatically the resources required to support the advanced web service features in a clustered environment. Although use of this extension template is not required, it makes the configuration of the required resources much
easier. Alternatively, you can configure the resources required for these advanced features using the Oracle WebLogic Server Administration Console or WLST.

In addition, the template installs scripts into the domain directory that can be used to manage the resource required for advanced web services in-sync as the domain evolves (for example, servers are added or removed, and so on).

For more information about how to configure the domain and run the scripts to manage resources, see Section 3.2, "Configuring Your Domain For Advanced Web Services Features."

23.4.3 Extending the Front-end SOAP Router to Support Web Services

You extend the front-end SOAP router to support web services by specifying the RoutingHandlerClassName parameter shown in the following example (in bold), as part of the WebLogic HTTP cluster servlet definition.

```
<!DOCTYPE web-app PUBLIC
"-//Sun Microsystems, Inc.//DTD Web Application 2.3//EN"
"http://java.sun.com/dtd/web-app_2_3.dtd">
<web-app>
  <servlet>
    <servlet-name>HttpClusterServlet</servlet-name>
    <servlet-class>weblogic.servlet.proxy.HttpClusterServlet</servlet-class>
    <init-param>
      <param-name>WebLogicCluster</param-name>
      <param-value>Server1:7001|Server2:7001</param-value>
    </init-param>
    <init-param>
      <param-name>RoutingHandlerClassName</param-name>
      <param-value>weblogic.wsee.jaxws.cluster.proxy.SOAPRoutingHandler</param-value>
    </init-param>
  </servlet>
  <servlet-mapping>
    <servlet-name>HttpClusterServlet</servlet-name>
    <url-pattern>/</url-pattern>
  </servlet-mapping>
  . . .
</web-app>
```

23.4.4 Enabling Routing of Web Services Atomic Transaction Messages

High availability and routing of web services atomic transaction messages is automatically enabled in web service clustered environments. However, if the WebLogic HTTP cluster servlet is being used as the front-end server, you need to set the following system property to false on the server hosting the WebLogic HTTP cluster servlet:

```
weblogic.wsee.wstx.wsat.deployed=false
```

In addition, when using a WebLogic Server plugin, you should configure the WLIOTimeoutSecs parameter value appropriately. This parameter defines the amount
of time the plug-in waits for a response to a request from WebLogic Server. If the value is less than the time the servlets take to process, then you may see unexpected results. For more information about the WLIOTimeoutSecs parameter, see "General Parameters for Web Server Plug-ins" in Using Oracle WebLogic Server Proxy Plug-Ins 12.2.1.

23.4.5 Enabling Routing of Web Services Make Connection Messages

To support Web Service Make Connection, as described in Section 12.6, "Using Asynchronous Web Service Clients From Behind a Firewall (Make Connection)," you must configure a default logical store on the WebLogic Server that is hosting the WebLogic HTTP cluster servlet. For information about configuring the default logical store, see Section 21.3.1, "Configuring the Logical Store."

23.4.6 Configuring the Identity of the Front-end SOAP Router

Each WebLogic Server instance in the cluster must be configured with the address and port of the front-end SOAP router.

You can configure the identity of the front-end SOAP router using one of the following methods, listed in order of precedence:

- Create a network channel, as describe in Section 23.4.7, "Configuring the Identity of the Front-end SOAP Router Using Network Channels." This is the recommended method.

- Configure the front-end host and port for the cluster, as described in "Configure HTTP Settings for a Cluster" in Oracle WebLogic Server Administration Console Online Help.

- Configure the front-end host and port for the local server, as described in "Configure HTTP Protocol" in Oracle WebLogic Server Administration Console Online Help.

- Define the Cluster Address for the cluster, as described in "Configure Clusters" in Oracle WebLogic Server Administration Console Online Help. The Cluster Address is required if no other values are set.

23.4.7 Configuring the Identity of the Front-end SOAP Router Using Network Channels

Network channels enable you to provide a consistent way to access the front-end address of a cluster. For more information about network channels, see "Understanding Network Channels" in Administering Server Environments for Oracle WebLogic Server.

To configure the identity of the front-end SOAP router using network channels, for each server instance:

1. Create a network channel for the protocol you use to invoke the web service. You must name the network channel weblogic-wsee-proxy-channel-XXX, where XXX refers to the protocol. For example, to create a network channel for HTTPS, call it weblogic-wsee-proxy-channel-https.

   See “Configure custom network channels” in Oracle WebLogic Server Administration Console Online Help for general information about creating a network channel.

2. Configure the network channel, updating the External Listen Address and External Listen Port fields with the address and port of the proxy server, respectively.
23.5 Monitoring Cluster Routing Performance

You can monitor the following cluster routing statistics to evaluate the application performance:

- Total number of requests and responses.
- Total number of requests and responses that were routed specifically to the server.
- Routing failure information, including totals and last occurrence.

You can use the WebLogic Server Administration Console or WLST to monitor cluster routing performance. For information about using WebLogic Server Administration Console to monitor cluster routing performance, see "Monitor SOAP web services" and "Monitor SOAP web service clients," in Oracle WebLogic Server Administration Console Online Help.
This chapter describes how to develop web service provider-based endpoints and dispatch clients to operate on SOAP messages at the XML message level for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 24.1, "Overview of Web Service Provider-based Endpoints and Dispatch Clients"
- Section 24.2, "Usage Modes and Message Formats for Operating at the XML Level"
- Section 24.3, "Developing a Web Service Provider-based Endpoint (Starting from Java)"
- Section 24.4, "Developing a Web Service Provider-based Endpoint (Starting from WSDL)"
- Section 24.5, "Using SOAP Handlers with Provider-based Endpoints"
- Section 24.6, "Developing a Web Service Dispatch Client"

### 24.1 Overview of Web Service Provider-based Endpoints and Dispatch Clients

Although the use of JAXB-generated classes is simpler, faster, and likely to be less error prone, there are times when you may want to generate your own business logic to manipulate the XML message content directly. Message-level access can be accomplished on the server side using web service Provider-based endpoints, and on the client side using Dispatch clients.

A **web service Provider-based endpoint** offers a dynamic alternative to the Java service endpoint interface (SEI)-based endpoint. Unlike the SEI-based endpoint that abstracts the details of converting between Java objects and their XML representation, the Provider interface enables you to access the content directly at the XML message level—without the JAXB binding. Web service Provider-based endpoints can be implemented synchronously or asynchronously using the `javax.xml.ws.Provider<T>` or `com.sun.xml.ws.api.server.AsyncProvider<T>` interfaces, respectively. For more information about developing web service Provider-based endpoints, see Section 24.3, "Developing a Web Service Provider-based Endpoint (Starting from Java)."

A **web service Dispatch client**, implemented using the `javax.xml.ws.Dispatch<T>` interface, enables clients to work with messages at the XML level. The steps to develop a web service Dispatch client are described in Section 24.6, "Developing a Web Service Dispatch Client".
Provider endpoints and Dispatch clients can be used in combination with other WebLogic web services features as long as a WSDL is available, including:
- WS-Security
- WS-ReliableMessaging
- WS-MakeConnection
- WS-AtomicTransaction

In addition, Dispatch clients can be used in combination with the asynchronous client transport and asynchronous client handler features. These features are described in detail in Chapter 12, "Developing Asynchronous Clients," and a code example is provided in Section 24.6.2, "Creating a Dispatch Instance."

### 24.2 Usage Modes and Message Formats for Operating at the XML Level

When operating on messages at the XML level using Provider-based endpoints or Dispatch clients, you use one of the usage modes defined in the following table. You define the usage mode using the `javax.xml.ws.ServiceMode` annotation, as described in Section 24.3.5, "Specifying the Usage Mode (@ServiceMode Annotation)."

#### Table 24–1 Usage Modes for Operating at the XML Message Level

<table>
<thead>
<tr>
<th>Usage Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message</td>
<td>Operates directly with the entire message. For example, if a SOAP binding is used, then the entire SOAP envelope is accessed.</td>
</tr>
<tr>
<td>Payload</td>
<td>Operates on the payload of a message only. For example, if a SOAP binding is used, then the SOAP body is accessed.</td>
</tr>
</tbody>
</table>

Provider-based endpoints and Dispatch clients can receive and send messages using one of the message formats defined in Table 24–2. This table also defines the valid message format and usage mode combinations based on the configured binding type (SOAP or XML over HTTP).

#### Table 24–2 Message Formats Supported for Operating at the XML Message Level

<table>
<thead>
<tr>
<th>Message Format</th>
<th>Usage Mode Support for SOAP/HTTP Binding</th>
<th>Usage Mode Support for XML/HTTP Binding</th>
</tr>
</thead>
<tbody>
<tr>
<td>javax.xml.transform.Source</td>
<td>Message mode: SOAP envelope</td>
<td>Message mode: XML content as Source</td>
</tr>
<tr>
<td></td>
<td>Payload mode: SOAP body</td>
<td>Payload mode: XML content as Source</td>
</tr>
<tr>
<td>javax.activation.DataSource</td>
<td>Not valid in either mode because attachments in SOAP/HTTP binding are sent using SOAPMessage format.</td>
<td>Message mode: DataSource object</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not valid in payload mode because DataSource is used for sending attachments.</td>
</tr>
<tr>
<td>javax.xml.soap.SOAPMessage</td>
<td>Message mode: SOAPMessage object</td>
<td>Not valid in either mode because the client can send a non-SOAP message in XML/HTTP binding.</td>
</tr>
<tr>
<td></td>
<td>Not valid in payload mode because the entire SOAP message is received, not just the payload.</td>
<td></td>
</tr>
</tbody>
</table>
24.3 Developing a Web Service Provider-based Endpoint (Starting from Java)

You can develop both synchronous and asynchronous web service Provider-based endpoints, as described in the following sections:

- Section 24.3.1, "Developing a Synchronous Provider-based Endpoint"
- Section 24.3.2, "Developing an Asynchronous Provider-based Endpoint"

**Note:** To start from WSDL and flag a port as a web service provider, see Section 24.4, "Developing a Web Service Provider-based Endpoint (Starting from WSDL)".

### 24.3.1 Developing a Synchronous Provider-based Endpoint

A web service Provider-based endpoint, implemented using the `javax.xml.ws.Provider<T>`, enables you to access content directly at the XML message level—without the JAXB binding. The `Provider` interface processes messages synchronously—the service waits to process the response before continuing with its work. For more information about the `javax.xml.ws.Provider<T>` interface, see [http://docs.oracle.com/javaee/7/api/javax/xml/ws/Provider.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/Provider.html).

The following procedure describes the typical steps for programming a JWS file that implements a synchronous web service Provider-based endpoint.

**Table 24–3  Steps to Develop a Synchronous Web Service Provider-based Endpoint**

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1  | Import the JWS annotations that will be used in your web service Provider-based JWS file. | The standard JWS annotations for a web service Provider-based JWS file include:  
import javax.xml.ws.Provider;  
import javax.xml.ws.WebServiceProvider;  
import javax.xml.ws.ServiceMode;  
Import additional annotations, as required. For a complete list of JWS annotations that are supported, see "Web Service Annotation Support" in WebLogic Web Services Reference for Oracle WebLogic Server. |
| 2  | Specify one of the message formats supported, defined in Table 24–2, when developing the Provider-based implementation class. | See Section 24.3.3, "Specifying the Message Format". |
The following sample JWS file shows how to implement a simple synchronous web service Provider-based endpoint. The steps to develop a synchronous web service Provider-based endpoint are described in detail in the sections that follow. To review the JWS file within the context of a complete sample, see “Creating JAX-WS Web Services for Java EE” in the Web Services Samples distributed with Oracle WebLogic Server.

**Note:** RESTful Web Services can be built using XML/HTTP binding Provider-based endpoints. For an example of programming a Provider-based endpoint within the context of a RESTful web service, see Section 30, "Programming Web Services Using XML Over HTTP."

---

### Example 24–1 Example of a JWS File that Implements a Synchronous Provider-based Endpoint

```java
package examples.webservices.jaxws;

import org.w3c.dom.Node;
import javax.xml.transform.Source;
import javax.xml.transform.TransformerFactory;
import javax.xml.transform.Transformer;
import javax.xml.transform.dom.DOMResult;
import javax.xml.transform.stream.StreamSource;
import javax.xml.ws.Provider;
import javax.xml.ws.ServiceMode;
import javax.xml.ws.WebServiceProvider;
import javax.xml.ws.Service;
import java.io.ByteArrayInputStream;

/**
 * A simple Provider-based web service implementation.
 *
 * @author Copyright (c) 2010, Oracle and/or its affiliates.
 * All Rights Reserved.
 */
```
The @ServiceMode annotation specifies whether the Provider instance receives entire messages or message payloads.

@ServiceMode(value = Service.Mode.PAYLOAD)

Standard JWS annotation that configures the Provider-based web service.

@WebServiceProvider(portName = "SimpleClientPort",
serviceName = "SimpleClientService",
targetNamespace = "http://jaxws.webservices.examples/",
wsdlLocation = "SimpleClientService.wsdl")

public class SimpleClientProviderImpl implements Provider<Source> {

// Invokes an operation according to the contents of the request message.
public Source invoke(Source source) {
    try {
        DOMResult dom = new DOMResult();
        Transformer trans = TransformerFactory.newInstance().newTransformer();
        Node node = dom.getNode();
        // Get the operation name node.
        Node root = node.getFirstChild();
        // Get the parameter node.
        Node first = root.getFirstChild();
        String input = first.getFirstChild().getNodeValue();
        // Get the operation name.
        String op = root.getLocalName();
        if ("invokeNoTransaction".equals(op)) {
            return sendSource(input);
        } else {
            return sendSource2(input);
        }
    } catch (Exception e) {
        throw new RuntimeException("Error in provider endpoint", e);
    }
}

private Source sendSource(String input) {
    String body =
        "<ns:invokeNoTransactionResponse
         xmlns:ns="http://jaxws.webservices.examples/"
         <return>
           constructed:" + input
         </return></ns:invokeNoTransactionResponse>";
    Source source = new StreamSource(new ByteArrayInputStream(body.getBytes()));
    return source;
}

private Source sendSource2(String input) {
    String body =
        "<ns:invokeTransactionResponse
         xmlns:ns="http://jaxws.webservices.examples/"
         <return>
           constructed:" + input
         </return></ns:invokeTransactionResponse>";
    Source source = new StreamSource(new ByteArrayInputStream(body.getBytes()));
    return source;
}
Developing a Web Service Provider-based Endpoint (Starting from Java)

24.3.2 Developing an Asynchronous Provider-based Endpoint

As with the Provider interface, web service Provider-based endpoints implemented using the com.sun.xml.ws.api.server.AsyncProvider<T> interface enable you to access content directly at the XML message level—without the JAXB binding. However, the AsyncProvider interface processes messages asynchronously—the service can continue its work and process the request when it becomes available, without blocking the thread.

The following procedure describes the typical steps for programming a JWS file that implements an asynchronous web service Provider-based endpoint.

Table 24–4  Steps to Develop an Asynchronous Web Service Provider-based Endpoint

<table>
<thead>
<tr>
<th>#</th>
<th>Step Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Import the JWS annotations that will be used in your web service Provider-based JWS file. The standard JWS annotations for an asynchronous web service Provider-based JWS file include: import com.sun.xml.ws.api.server.AsyncProvider; import com.sun.xml.ws.api.server.AsyncProviderCallback; import javax.xml.ws.ServiceMode; Import additional annotations, as required. For a complete list of JWS annotations that are supported, see “Web Service Annotation Support” in WebLogic Web Services Reference for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>2</td>
<td>Specify one of the message formats supported, defined in Table 24–2, when developing the Provider-based implementation class. See Section 24.3.3, “Specifying the Message Format”.</td>
</tr>
<tr>
<td>3</td>
<td>Add the standard required @WebServiceProvider JWS annotation at the class level to specify that the Java class exposes a web service provider. See Section 24.3.4, &quot;Specifying that the JWS File Implements a Web Service Provider (@WebServiceProvider Annotation).&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Add the standard @ServiceMode JWS annotation at the class level to specify whether the web service provider is accessing information at the message or message payload level. (Optional) The service mode defaults to Service.Mode.Payload. See Section 24.3.5, &quot;Specifying the Usage Mode (@ServiceMode Annotation).&quot;</td>
</tr>
<tr>
<td>5</td>
<td>Define the invoke() method. The invoke() method is called and provides the message or message payload as input to the method using the specified message format. See Section 24.3.7, &quot;Defining the invoke() Method for an Asynchronous Provider-based Endpoints.&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Define the asynchronous handler callback method to handle the response. The method handles the response when it is returned. See Section 24.3.8, &quot;Defining the Callback Handler for the Asynchronous Provider-based Endpoint.&quot;</td>
</tr>
</tbody>
</table>

The following sample JWS file shows how to implement a simple asynchronous web service Provider-based endpoint. The steps to develop an asynchronous web service Provider-based endpoint are described in detail in the sections that follow.

Example 24–2  Example of a JWS File that Implements an Asynchronous Provider-based Endpoint

package asyncprovider.server;
import com.sun.xml.ws.api.server.AsyncProvider;
import com.sun.xml.ws.api.server.AsyncProviderCallback;

import javax.xml.bind.JAXBContext;
import javax.xml.transform.Source;
import javax.xml.transform.stream.StreamSource;
import javax.xml.ws.WebServiceContext;
import javax.xml.ws.WebServiceException;
import javax.xml.ws.WebServiceProvider;
import java.io.ByteArrayInputStream;
import java.io.ByteArrayOutputStream;

@WebServiceProvider(
    wsdlLocation="WEB-INF/wsdl/hello_literal.wsdl",
    targetNamespace = "urn:test",
    serviceName="Hello")
public class HelloAsyncImpl implements AsyncProvider<Source> {

    private static final JAXBContext jaxbContext = createJAXBContext();
    private int bodyIndex;

    public javax.xml.bind.JAXBContext getJAXBContext(){
        return jaxbContext;
    }

    private static javax.xml.bind.JAXBContext createJAXBContext(){
        try{
            return javax.xml.bind.JAXBContext.newInstance(ObjectFactory.class);
        }catch(javax.xml.bind.JAXBException e){
            throw new WebServiceException(e.getMessage(), e);
        }
    }

    private Source sendSource() {
        System.out.println("**** sendSource ******");
        String[] body = {
            "<HelloResponse xmlns="urn:test:types">
                <argument xmlns="">foo</argument>
                <extra xmlns="">bar</extra>
            </HelloResponse>",
            "<ans1:HelloResponse xmlns:ans1="urn:test:types">
                <argument>foo</argument>
                <extra>bar</extra>
            </ans1:HelloResponse>",
        };
        int i = (++bodyIndex)%body.length;
        return new StreamSource(
            new ByteArrayInputStream(body[i].getBytes()));
    }

    private Hello_Type recvBean(Source source) throws Exception {
        System.out.println("**** recvBean ******");
        return (Hello_Type)jaxbContext.createUnmarshaller().unmarshal(source);
    }

    private Source sendBean() throws Exception {
        System.out.println("**** sendBean ******");
        HelloResponse resp = new HelloResponse();
        return sendBean();
    }
}
resp.setArgument("foo");
resp.setExtra("bar");
ByteArrayOutputStream bout = new ByteArrayOutputStream();
jaxbContext.createMarshaller().marshal(resp, bout);
return new StreamSource(new ByteArrayInputStream(bout.toByteArray()));
}

public void invoke(Source source, AsyncProviderCallback<Source> cbak,
WebServiceContext ctxt) {
System.out.println("**** Received in AsyncProvider Impl ******");
try {
    Hello_Type hello = recvBean(source);
    String arg = hello.getArgument();
    if (arg.equals("sync")) {
        String extra = hello.getExtra();
        if (extra.equals("source")) {
            cbak.send(sendSource());
        } else if (extra.equals("bean")) {
            cbak.send(sendBean());
        } else {
            throw new WebServiceException("Expected extra =
                           (source|bean|fault), Got="+extra);
        }
    } else if (arg.equals("async")) {
        new Thread(new RequestHandler(cbak, hello)).start();
    } else {
        throw new WebServiceException("Expected Argument =
                           (sync|async), Got="+arg);
    }
} catch(Exception e) {
    throw new WebServiceException("Endpoint failed", e);
}
}

private class RequestHandler implements Runnable {
    final AsyncProviderCallback<Source> cbak;
    final Hello_Type hello;
    public RequestHandler(AsyncProviderCallback<Source> cbak, Hello_Type hello) {
        this.cbak = cbak;
        this.hello = hello;
    }

    public void run() {
        try {
            Thread.sleep(5000);
        } catch(InterruptedException ie) {
            cbak.sendError(new WebServiceException("Interrupted..."));
            return;
        }
        try {
            String extra = hello.getExtra();
            if (extra.equals("source")) {
                cbak.send(sendSource());
            } else if (extra.equals("bean")) {
                cbak.send(sendBean());
            } else {
                cbak.sendError(new WebServiceException("Expected extra =
                           (source|bean|fault), Got="+extra));
            }
        } catch(Exception e) {

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Specify one of the message formats supported, defined in Table 24–2, when developing the Provider-based implementation class.

For example, in the Provider implementation example shown in Example 24–1, "Example of a JWS File that Implements a Synchronous Provider-based Endpoint", the SimpleClientProviderImpl class implements the Provider<Source> interface, indicating that both the input and output types are java.xml.transform.Source objects.

```java
public class SimpleClientProviderImpl implements Provider<Source> {
    ...
}
```

Similarly, in the AsyncProvider implementation example shown in Example 24–2, "Example of a JWS File that Implements an Asynchronous Provider-based Endpoint", the HelloAsyncImpl class implements the AsyncProvider<Source> interface, indicating that both the input and output types are java.xml.transform.Source objects.

```java
public class HelloAsyncImpl implements AsyncProvider<Source>  {
    ...
}
```

### 24.3.4 Specifying that the JWS File Implements a Web Service Provider (@WebServiceProvider Annotation)

Use the standard javax.xml.ws.WebServiceProvider annotation to specify, at the class level, that the JWS file implements a web service provider, as shown in the following code excerpt:

```java
@WebServiceProvider(portName = "SimpleClientPort",
    serviceName = "SimpleClientService",
    targetNamespace = "http://jaxws.webservices.examples/",
    wsdlLocation = "SimpleClientService.wsdl")
```

In the example, the service name is SimpleClientService, which will map to the wsdl:service element in the generated WSDL file. The port name is SimpleClientPort, which will map to the wsdl:port element in the generated WSDL. The target namespace used in the generated WSDL is http://jaxws.webservices.examples/ and the WSDL location is local to the web service provider, at SimpleClientService.wsdl.

For more information about the @WebServiceProvider annotation, see [https://jax-ws.java.net/nonav/2.1.5/docs/annotations.html](https://jax-ws.java.net/nonav/2.1.5/docs/annotations.html).
24.3.5 Specifying the Usage Mode (@ServiceMode Annotation)

The `javax.xml.ws.ServiceMode` annotation is used to specify whether the web service Provider-based endpoint receives entire messages (`Service.Mode.MESSAGE`) or message payloads (`Service.Mode.PAYLOAD`) only.

For example:

```java
@ServiceMode(value = Service.Mode.PAYLOAD)
```

If not specified, the `@ServiceMode` annotation defaults to `Service.Mode.PAYLOAD`.

For a list of valid message format and usage mode combinations, see Table 24–2.

For more information about the `@ServiceMode` annotation, see [https://jax-ws.java.net/nonav/2.1.4/docs/annotations.html](https://jax-ws.java.net/nonav/2.1.4/docs/annotations.html).

24.3.6 Defining the invoke() Method for a Synchronous Provider-based Endpoints

The `Provider<T>` interface defines a single method that you must define in your implementation class:

```java
T invoke(T request)
```

When a web service request is received, the `invoke()` method is called and provides the message or message payload as input to the method using the specified message format.

For example, in the Provider implementation example shown in Section 24–1, "Example of a JWS File that Implements a Synchronous Provider-based Endpoint", excerpted below, the class defines an `invoke` method to take as input the `Source` parameter and return a `Source` response.

```java
public Source invoke(Source source) {
    try {
        DOMResult dom = new DOMResult();
        Transformer trans = TransformerFactory.newInstance().newTransformer();
        trans.transform(source, dom);
        Node node = dom.getNode();
        // Get the operation name node.
        Node root = node.getFirstChild();
        // Get the parameter node.
        Node first = root.getFirstChild();
        String input = first.getFirstChild().getNodeValue();
        // Get the operation name.
        String op = root.getLocalName();
        if ("invokeNoTransaction".equals(op)) {
            return sendSource(input);
        } else {
            return sendSource2(input);
        }
    } catch (Exception e) {
        throw new RuntimeException("Error in provider endpoint", e);
    }
}
```

24.3.7 Defining the invoke() Method for an Asynchronous Provider-based Endpoints

The `AsyncProvider<T>` interface defines a single method that you must define in your implementation class:
void invoke(T request, AsyncProviderCallback<t> callback, WebserviceContext context))

You pass the following parameters to the invoke method:

- Request message or message payload in the specified format.
- com.sun.xml.ws.api.server.AsyncProviderCallback implementation that will handle the response once it is returned. For more information, see Section 24.3.8, "Defining the Callback Handler for the Asynchronous Provider-based Endpoint".
- The javax.xml.ws.WebServiceContext that defines the message context for the request being served. An asynchronous Provider-based endpoint cannot use the injected WebServiceContext which relies on the calling thread to determine the request it should return information about. Instead, it passes the WebServiceContext object which remains usable until you invoke AsyncProviderCallback.

For example, in the AysncProvider implementation example shown in Example 24–2, "Example of a JWS File that Implements an Asynchronous Provider-based Endpoint", excerpted below, the class defines an invoke method as shown below:

```java
public void invoke(Source source, AsyncProviderCallback<Source> cbak, WebserviceContext ctxt) {
    System.out.println("**** Received in AsyncProvider Impl ******");
    try {
        Hello_Type hello = recvBean(source);
        String arg = hello.getArgument();
        if (arg.equals("sync")) {
            String extra = hello.getExtra();
            if (extra.equals("source")) {
                cbak.send(sendSource());
            } else if (extra.equals("bean")) {
                cbak.send(sendBean());
            } else {
                throw new WebServiceException("Expected extra = (source|bean|fault), Got="+extra);
            }
        } else if (arg.equals("async")) {
            new Thread(new RequestHandler(cbak, hello)).start();
        } else {
            throw new WebServiceException("Expected Argument = (sync|async), Got="+arg);
        }
    } catch(Exception e) {
        throw new WebServiceException("Endpoint failed", e);
    }
}
```

### 24.3.8 Defining the Callback Handler for the Asynchronous Provider-based Endpoint

The AsyncProviderCallback interface enables you to define a callback handler for processing the asynchronous response once it is received.

For example, in the AysncProvider implementation example shown in Example 24–2, "Example of a JWS File that Implements an Asynchronous Provider-based Endpoint", excerpted below, the RequestHandler method uses the AsyncProviderCallback callback handler to process the asynchronous response:

```java
private class RequestHandler implements Runnable {
    ```
final AsyncProviderCallback<Source> cbak;
final Hello_Type hello;
public RequestHandler(AsyncProviderCallback<Source> cbak, Hello_Type hello) {
    this.cbak = cbak;
    this.hello = hello;
}

public void run() {
    try {
        Thread.sleep(5000);
    } catch(InterruptedException ie) {
        cbak.sendError(new WebServiceException("Interrupted..."));
        return;
    }
    try {
        String extra = hello.getExtra();
        if (extra.equals("source")) {
            cbak.send(sendSource());
        } else if (extra.equals("bean")) {
            cbak.send(sendBean());
        } else {
            cbak.sendError(new WebServiceException("Expected extra = (source|bean|fault), Got="+extra));
        }
    } catch(Exception e) {
        cbak.sendError(new WebServiceException(e));
    }
}

24.4 Developing a Web Service Provider-based Endpoint (Starting from WSDL)

If the Provider-based endpoint is being generated from a WSDL file, the <provider> WSDL extension can be used to mark a port as a provider. For example:

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<bindings wsdlLocation="SimpleClientService.wsdl"
  xmlns="http://java.sun.com/xml/ns/jaxws"
  xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
    <package name="provider.server"/>
    <provider>true</provider>
</bindings>
```

24.5 Using SOAP Handlers with Provider-based Endpoints

Provider-based endpoints may need to access the SOAP message for additional processing of the message request or response. You can create SOAP message handlers to enable Provider-based endpoints to perform this additional processing on the SOAP message, just as you do for an SEI-based endpoint. For more information about creating the SOAP handler, see "Creating the SOAP Message Handler" on page 18-5.

Table 18–1, "Steps to Add SOAP Message Handlers to a Web Service" enumerates the steps required to add a SOAP handler to a web service. These steps apply to web service Provider-based endpoints, as well.
For example:

1. Design SOAP message handlers and group them together in a *handler chain*, as described in Section 18.4, "Designing the SOAP Message Handlers and Handler Chains."

2. For each handler in the handler chain, create a Java class that implements the SOAP message handler interface, as described in Section 18.5, "Creating the SOAP Message Handler."

An example of the SOAP handler, `MyHandler`, is shown below.

```java
package provider.rootpart_charset_772.server;

import javax.activation.DataHandler;
import javax.activation.DataSource;
import javax.xml.namespace.QName;
import javax.xml.soap.AttachmentPart;
import javax.xml.soap.SOAPMessage;
import javax.xml.ws.WebServiceException;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.handler.soap.SOAPHandler;
import javax.xml.ws.handler.soap.SOAPMessageContext;
import java.io.InputStream;
import java.io.OutputStream;
import java.io.ByteArrayInputStream;
import java.util.Set;

public class MyHandler implements SOAPHandler<SOAPMessageContext> {

    public Set<QName> getHeaders() {
        return null;
    }

    public boolean handleMessage(SOAPMessageContext smc) {
        if (!(Boolean)smc.get(MessageContext.MESSAGE_OUTBOUND_PROPERTY))
            return true;

        try {
            SOAPMessage msg = smc.getMessage();
            AttachmentPart part = msg.createAttachmentPart(getDataHandler());
            part.setContentId("SOAPTestHandler@example.jaxws.sun.com");
            msg.addAttachmentPart(part);
            msg.saveChanges();
            smc.setMessage(msg);
        } catch (Exception e) {
            throw new WebServiceException(e);
        }
        return true;
    }

    public boolean handleFault(SOAPMessageContext context) {
        return true;
    }

    public void close(MessageContext context) {}

    private DataHandler getDataHandler() throws Exception {
        return new DataHandler(new DataSource() {
            public String getContentType() {
                return "text/xml";
            }
        });
    }
}
```
public InputStream getInputStream() {
    return new ByteArrayInputStream("<a/>".getBytes());
}

public String getName() {
    return null;
}

public OutputStream getOutputStream() {
    throw new UnsupportedOperationException();
}

3. Add the @javax.jws.HandlerChain annotation to the Provider implementation, as described in Section 18.6, "Configuring Handler Chains in the JWS File."

For example:

```java
package provider.rootpart_charset_772.server;

import javax.jws.HandlerChain;
import javax.xml.soap.MessageFactory;
import javax.xml.soap.SOAPMessage;
import javax.xml.transform.Source;
import javax.xml.transform.stream.StreamSource;
import javax.xml.ws.*
import java.io.ByteArrayInputStream;

@WebServiceProvider(targetNamespace="urn:test", portName="HelloPort",
serviceName="Hello")
@ServiceMode(value=Service.Mode.MESSAGE)
@HandlerChain(file="handlers.xml")
public class SOAPMsgProvider implements Provider<SOAPMessage> {

    public SOAPMessage invoke(SOAPMessage msg) {
        try {
            // keeping white space in the string is intentional
            String content = "<soapenv:Envelope
                xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
            <soapenv:Body>  <VoidTestResponse
                xmlns="urn:test:types">
            </VoidTestResponse></soapenv:Body></soapenv:Envelope>";

            Source source = new StreamSource(new ByteArrayInputStream(content.getBytes()));
            MessageFactory fact = MessageFactory.newInstance();
            SOAPMessage soap = fact.createMessage();
            soap.getSOAPPart().setContent(source);
            soap.getMimeHeaders().addHeader("foo", "bar");
            return soap;
        } catch(Exception e) {
            throw new WebServiceException(e);
        }
    }
}

4. Create the handler chain configuration file, as described in Section 18.7, "Creating the Handler Chain Configuration File."

An example of the handler chain configuration file, handlers.xml, is shown below.
Developing a Web Service Dispatch Client

Using Provider-based Endpoints and Dispatch Clients to Operate on SOAP Messages

24.6 Developing a Web Service Dispatch Client

A web service Dispatch client, implemented using the javax.xml.ws.Dispatch<T> interface, enables clients to work with messages at the XML level.

The following procedure describes the typical steps for programming a web service Dispatch client.

Table 24–5 Steps to Develop a Web Service Provider-based Endpoint

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Import the JWS annotations that will be used in your web service Provider-based JWS file.</td>
<td>The standard JWS annotations for a web service Provider-based JWS file include: import javax.xml.ws.Service; import javax.xml.ws.Dispatch; import javax.xml.ws.ServiceMode; Import additional annotations, as required. For a complete list of JWS annotations that are supported, see &quot;Web Service Annotation Support&quot; in WebLogic Web Services Reference for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>2</td>
<td>Create a Dispatch instance.</td>
<td>See Section 24.6.2, &quot;Creating a Dispatch Instance&quot;.</td>
</tr>
<tr>
<td>3</td>
<td>Invoke a web service operation.</td>
<td>You can invoke a web service operation synchronously (one-way or two-way) or asynchronously (polling or asynchronous handler). See Section 24.6.3, &quot;Invoking a Web Service Operation&quot;.</td>
</tr>
</tbody>
</table>

24.6.1 Example of a Web Service Dispatch Client

The following sample shows how to implement a basic web service Dispatch client. The sample is described in detail in the sections that follow.

Example 24–3 Example of a Web Service Dispatch Client

```java
package jaxws.dispatch.client;

import java.io.ByteArrayOutputStream;
import java.io.OutputStream;
import java.io.StringReader;
import java.net.URL;
import javax.xml.soap.SOAPException;
import javax.xml.soap.SOAPMessage;
import javax.xml.transform.OutputKeys;
import javax.xml.transform.Source;
import javax.xml.transform.Transformer;
```
import javax.xml.transform.TransformerException;
import javax.xml.transform.TransformerFactory;
import javax.xml.transform.stream.StreamResult;
import javax.xml.transform.stream.StreamSource;
import javax.xml.ws.Dispatch;
import javax.xml.ws.Service;
import javax.xml.ws.WebServiceException;
import javax.xml.bind.JAXBContext;
import javax.xml.bind.JAXBElement;
import javax.xml.namespace.QName;
import javax.xml.ws.soap.SOAPBinding;

public class WebTest extends TestCase {
    private static String in_str = "wiseking";
    private static String request =  
"<ns1:sayHello xmlns:ns1="http://example.org">"+in_str+'</arg0></ns1:sayHello>";
    private static final QName portQName = new QName("http://example.org", "SimplePort");
    private Service service = null;
    
    protected void setUp() throws Exception {
        String url_str = System.getProperty("wsdl");
        URL url = new URL(url_str);
        QName serviceName = new QName("http://example.org", "SimpleImplService");
        service = Service.create(serviceName);
        service.addPort(portQName, SOAPBinding.SOAP11HTTP_BINDING, url_str);
        System.out.println("Setup complete.");
    }
    
    public void testSayHelloSource() throws Exception {
        setUp();
        Dispatch<Source> sourceDispatch = 
service.createDispatch(portQName, Source.class, Service.Mode.PAYLOAD);
        System.out.println("Invoking xml request: " + request);
        Source result = sourceDispatch.invoke(new StreamSource(new StringReader(request)));
        String xmlResult = sourceToXMLString(result);
        System.out.println("Received xml response: " + xmlResult);
        assertTrue(xmlResult.indexOf("HELLO:"+in_str)>=0);
    }
    
    private String sourceToXMLString(Source result) {
        String xmlResult = null;
        try {
            TransformerFactory factory = TransformerFactory.newInstance();
            Transformer transformer = factory.newTransformer();
            transformer.setOutputProperty(OutputKeys.OMIT_XML_DECLARATION, "yes");
            transformer.setOutputProperty(OutputKeys.METHOD, "xml");
            OutputStream out = new ByteArrayOutputStream();
            StreamResult streamResult = new StreamResult(out);
            transformer.transform(result, streamResult);
            xmlResult = streamResult.getOutputStream().toString();
        } catch (TransformerException e) {
            e.printStackTrace();
        }
        return xmlResult;
    }
}
24.6.2 Creating a Dispatch Instance

The javax.xml.ws.Service interface acts as a factory for the creation of Dispatch instances. So to create a Dispatch instance, you must first create a Service instance. Then, create the Dispatch instance using the Service.createDispatch() method.

You can pass one or more of the following parameters to the createDispatch() method:

- Qualified name (QName) or endpoint reference of the target service endpoint.

- Class of the type parameter T. In this example, the javax.xml.transform.Source format is used. For valid values, see Table 24–2.

- Usage mode. In this example, the message payload is specified. For valid usage modes, see Table 24–1.

- A list of web service features to configure on the proxy.

- JAXB context used to marshal or unmarshal messages or message payloads.

For more information about the valid parameters that can be used to call the Service.createDispatch() method, see the javax.xml.ws.Service Javadoc at: https://jax-ws.java.net/nonav/2.1.1/docs/api/javax/xml/ws/Service.html.

For example:

```java
... String url_str = System.getProperty("wsdl");
    QName serviceName = new QName("http://example.org", "SimpleImplService");
    service = Service.create(serviceName);
    service.addPort(portQName, SOAPBinding.SOAP11HTTP_BINDING, url_str);
    Dispatch<Source> sourceDispatch =
        service.createDispatch(portQName, Source.class, Service.Mode.PAYLOAD);
... 
```

In the example above, the createDispatch() method takes three parameters:

- Qualified name (QName) of the target service endpoint.

- Class of the type parameter T. In this example, the javax.xml.transform.Source format is used. For valid values, see Table 24–2.

- Usage mode. In this example, the message payload is specified. For valid usage modes, see Table 24–1.

The following example shows how to pass a list of web service features, specifically the asynchronous client transport feature and asynchronous client handler feature. For more information about these features, see Chapter 12, "Developing Asynchronous Clients."

```java
... protected Dispatch createDispatch(boolean isSoap12, Class dateType,
    Service.Mode mode, AsycClientHandlerFeature feature) 
    throws Exception {
     String address = publishEndpoint(isSoap12);
     Service service = Service.create(new URL(address + "?wsdl"),
         new QName("http://example.org", "AddNumbersService"));
     QName portName = new QName("http://example.org", "AddNumbersPort");
     AsyncClientTransportFeature transportFeature = new
... 
```


AsyncClientTransportFeature("http://localhost:8238/clientsoap12/" +
        UUID.randomUUID().toString());
    Dispatch dispatch = service.createDispatch(portName, dateType, mode,
        feature, transportFeature);
    return dispatch;
}

24.6.3 Invoking a Web Service Operation

Once the Dispatch instance is created, use it to invoke a web service operation. You can invoke a web service operation synchronously (one-way or two-way) or asynchronously (polling or asynchronous handler). For complete details about the synchronous and asynchronous invoke methods, see the javax.xml.ws.Dispatch Javadoc at:
https://jax-ws.java.net/nonav/2.1.1/docs/api/javax/xml/ws/Dispatch.html

For example, in the following code excerpt, the XML message is encapsulated as a javax.xml.transform.stream.StreamSource object and passed to the synchronous invoke() method. The response XML is returned in the result variable as a Source object, and transformed back to XML. The sourcetoXMLString() method used to transform the message back to XML is shown in Example 24–3.

private static String request = "<ns1:sayHello xmlns:ns1="http://example.org">"+in_str+"</arg0></ns1:sayHello>";
    Source result = sourceDispatch.invoke(new StreamSource(new StringReader(request)));
    String xmlResult = sourcetoXMLString(result);
    ...

This chapter describes how use the methods available from 
com.sun.xml.ws.developer.WSBindingProvider to send outbound or receive inbound 
SOAP headers for WebLogic web services using Java API for XML Web Services 
(JAX-WS).

This chapter includes the following sections:

- Section 25.1, "Overview of Sending and Receiving SOAP Headers"
- Section 25.2, "Sending SOAP Headers Using WSBindingProvider"
- Section 25.3, "Receiving SOAP Headers Using WSBindingProvider"

Note: The com.sun.xml.ws.developer.WSBindingProvider and 
com.sun.xml.ws.api.message.Headers APIs are supported as an 
extension to the JDK 6.0. Because the APIs are not provided as part of 
the JDK 6.0 kit, they are subject to change.

25.1 Overview of Sending and Receiving SOAP Headers

When you create a proxy or Dispatch client, the client implements the 
javax.xml.ws.BindingProvider interface. If you need to send or receive a SOAP 
header, you can downcast the web service proxy or Dispatch client to 
com.sun.xml.ws.developer.WSBindingProvider and use the methods on the interface 
to send outbound or receive inbound SOAP headers.

25.2 Sending SOAP Headers Using WSBindingProvider

Use the setOutboundHeaders method to the 
com.sun.xml.ws.developer.WSBindingProvider to send SOAP headers. You create 

For example, the following provides a code excerpt showing how to pass a simple 
string value as a header.

Example 25–1  Sending SOAP Headers Using WSBindingProvider

import com.sun.xml.ws.developer.WSBindingProvider;
import com.sun.xml.ws.api.message.Headers;
import javax.xml.namespace.QName;
...
HelloService helloService = new HelloService();
HelloPort port = helloService.getHelloPort();
WSBindingProvider bp = (WSBindingProvider)port;
25.3 Receiving SOAP Headers Using WSBindingProvider

Use the `getInboundHeaders` method to the `com.sun.xml.ws.developer.WSBindingProvider` to receive SOAP headers.

For example, the following provides a code excerpt showing how to get inbound headers.

```
import com.sun.xml.ws.developer.WSBindingProvider;
import com.sun.xml.ws.api.message.Headers;
import javax.xml.namespace.QName;
import java.util.List;
...
HelloService helloService = new HelloService();
HelloPort port = helloService.getHelloPort();
WSBindingProvider bp = (WSBindingProvider)port;

List inboundHeaders = bp.getInboundHeaders();
...
This chapter describes how to use callbacks to notify clients of events for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

■ Overview of Callbacks
■ Example Callback Implementation
■ Steps to Program Callbacks
■ Programming Guidelines for Target Web Service
■ Programming Guidelines for the Callback Client Web Service
■ Programming Guidelines for the Callback Web Service
■ Updating the build.xml File for the Target Web Service

### 26.1 Overview of Callbacks

A callback is a contract between a client and service that allows the service to invoke operations on a client-provided endpoint during the invocation of a service method for the purpose of querying the client for additional data, allowing the client to inject behavior, or notifying the client of progress. The service advertises the requirements for the callback using a WSDL that defines the callback port type and the client informs the service of the callback endpoint address using WS-Addressing.

### 26.2 Example Callback Implementation

The example callback implementation described in this section consists of the following three Java files:

■ **JWS file that implements the callback web service**: The callback web service defines the callback methods. The implementation simply passes information back to the target web service that, in turn, passes the information back to the client web service.

  In the example in this section, the callback web service is called `CallbackService`. The web service defines a single callback method called `callback()`.

■ **JWS file that implements the target web service**: The target web service includes one or more standard operations that invoke a method defined in the callback web service and sends the message back to the client web service that originally invoked the operation of the target web service.
In the example, this web service is called TargetService and it defines a single standard method called targetOperation().

- JWS file that implements the client web service: The client web service invokes an operation of the target web service. Often, this web service will include one or more methods that specify what the client should do when it receives a callback message back from the target web service via a callback method.

In the example, this web service is called CallerService. The method that invokes TargetService in the standard way is called call().

The following shows the flow of messages for the example callback implementation.

**Figure 26–1 Example Callback Implementation**

1. The call() method of the CallerService web service, running in one WebLogic Server instance, explicitly invokes the targetOperation() method of the TargetService and passes a web service endpoint to the CallbackService. Typically, the TargetService service is running in a separate WebLogic Server instance.

2. The implementation of the TargetService.targetOperation() method explicitly invokes the callback() method of the CallbackService, which implements the callback service, using the web service endpoint that is passed in from CallerService when the method is called.

3. The CallbackService.callback() method sends information back to the TargetService web service.

4. The TargetService.targetOperation() method, in turn, sends the information back to the CallerService service, completing the callback sequence.

### 26.3 Steps to Program Callbacks

The procedure in this section describes how to program and compile the three JWS files that are required to implement callbacks: the target web service, the client web service, and the callback web service. The procedure shows how to create the JWS files from scratch; if you want to update existing JWS files, you can also use this procedure as a guide.

It is assumed that you have set up an Ant-based development environment and that you have a working build.xml file to which you can add targets for running the jwsc Ant task and deploying the web services. For more information, see Chapter 4, "Programming the JWS File."
Table 26–1  Steps to Program Callbacks

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create a new JWS file, or update an existing one, that implements the</td>
<td>Use your favorite IDE or text editor. See Section 26.4, “Programming Guidelines for Target Web Service”.</td>
</tr>
<tr>
<td></td>
<td>target web service.</td>
<td>Note: The JWS file that implements the target web service invokes one or more callback methods of the callback web service. However, the step that describes how to program the callback web service comes later in this procedure. For this reason, programmers typically program the three JWS files at the same time, rather than linearly as implied by this procedure. The steps are listed in this order for clarity only.</td>
</tr>
<tr>
<td>2</td>
<td>Update your build.xml file to include a call to the jwsc Ant task to</td>
<td>See Section 26.7, &quot;Updating the build.xml File for the Target Web Service&quot;.</td>
</tr>
<tr>
<td></td>
<td>compile the target JWS file into a web service.</td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prompt&gt; ant build-target</td>
</tr>
<tr>
<td>3</td>
<td>Run the Ant target to build the target web service.</td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prompt&gt; ant build-target</td>
</tr>
<tr>
<td>4</td>
<td>Deploy the target web service as usual.</td>
<td>See Chapter 3.9, &quot;Deploying and Undeploying WebLogic Web Services.&quot;</td>
</tr>
<tr>
<td>5</td>
<td>Create a new JWS file, or update an existing one, that implements the</td>
<td>It is assumed that the client web service is deployed to a different WebLogic Server instance from the one that hosts the target web service. See Section 26.5, &quot;Programming Guidelines for the Callback Client Web Service&quot;.</td>
</tr>
<tr>
<td></td>
<td>client web service.</td>
<td>See Section 26.6, &quot;Programming Guidelines for the Callback Web Service&quot;.</td>
</tr>
<tr>
<td>6</td>
<td>Create the JWS file that implements the callback web service.</td>
<td>The jwsc Ant task that builds the client web service also compiles CallbackWS.java and includes the class file in the WAR file using the Fileset Ant task element. For example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;clientgen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>type=&quot;JAXWS&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wsdl=&quot;${awsdl}&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>packageName=&quot;jaxws.callback.client.add&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;/clientgen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;clientgen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>type=&quot;JAXWS&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wsdl=&quot;${twsdl}&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>packageName=&quot;jaxws.callback.client.target&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;FileSet dir=&quot;.&quot; &gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;include name=&quot;CallbackWS.java&quot; /&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;/FileSet&gt;</td>
</tr>
<tr>
<td>7</td>
<td>Update the build.xml file that builds the client web service.</td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prompt&gt; ant build-caller</td>
</tr>
<tr>
<td>8</td>
<td>Run the Ant target to build the client and callback web services.</td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prompt&gt; ant build-caller</td>
</tr>
<tr>
<td>9</td>
<td>Deploy the client web service as usual.</td>
<td>See Chapter 3.9, &quot;Deploying and Undeploying WebLogic Web Services.&quot;</td>
</tr>
</tbody>
</table>

26.4  Programming Guidelines for Target Web Service

The following example shows a simple JWS file that implements the target web service; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

package examples.webservices.callback;
import javax.jws.WebService;
import javax.xml.ws.BindingType;
import javax.xml.ws.wsaddressing.W3CEndpointReference;
import examples.webservices.callback.callbackservice.*;

@WebService(
    portName="TargetPort",
    serviceName="TargetService",
    targetNamespace="http://example.oracle.com",
    endpointInterface= 
        "examples.webservices.callback.target.TargetPortType",
    wsdlLocation="/wsdls/Target.wsdl")
@BindingType(value="http://schemas.xmlsoap.org/wsdl/soap/http")
public class TargetImpl {
    public String targetOperation(String s, W3CEndpointReference callback)
    {
        CallbackService aservice = new CallbackService();
        CallbackPortType aport =
            aservice.getPort(callback, CallbackPortType.class);
        String result = aport.callback(s);
        return result + " processed by target";
    }
}

Follow these guidelines when programming the JWS file that implements the target web service. Code snippets of the guidelines are shown in **bold** in the preceding example.

- Import the packages required to pass the callback service endpoint and access the CallbackService stub implementation.
  
  ```java
  import javax.xml.ws.wsaddressing.W3CEndpointReference;
  import examples.webservices.callback.callbackservice.*;
  ```

- Create an instance of the CallbackService implementation using the stub implementation and get a port by passing the CallbackService service endpoint, which is passed by the calling application (CallerService).

  ```java
  CallbackService aservice = new CallbackService();
  CallbackPortType aport =
      aservice.getPort(callback, CallbackPortType.class);
  ```

- Invoke the callback operation of CallbackService using the port you instantiated:

  ```java
  String result = aport.callback(s);
  ```

- Return the result to the CallerService service.

  ```java
  return result + " processed by target";
  ```

### 26.5 Programming Guidelines for the Callback Client Web Service

The following example shows a simple JWS file for a client web service that invokes the target web service described in Section 26.4, "Programming Guidelines for Target Web Service"; see the explanation after the example for coding guidelines that correspond to the Java code in **bold**.

```java
package examples.webservices.callback;
```
import javax.annotation.Resource;
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.xml.ws.BindingType;
import javax.xml.ws.Endpoint;
import javax.xml.ws.WebServiceContext;
import javax.xml.ws.WebServiceException;
import javax.xml.ws.WebServiceRef;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.wsaddressing.W3CEndpointReference;
import examples.webservices.callback.target.*;

@WebService(
    portName="CallerPort",
    serviceName="CallerService",
    targetNamespace="http://example.oracle.com")
@BindingType(value="http://schemas.xmlsoap.org/wsdl/soap/http")
public class CallerImpl
{
    @Resource
    private WebServiceContext context;

    @WebServiceRef()
    private TargetService target;

    @WebMethod()
    public String call(String s) {
        Object sc =
            context.getMessageContext().get(MessageContext.SERVLET_CONTEXT);
        Endpoint callbackImpl = Endpoint.create(new CallbackWS());
        callbackImpl.publish(sc);
        TargetPortType tPort = target.getTargetPort();
        String result = tPort.targetOperation(s,
            callbackImpl.getEndpointReference(W3CEndpointReference.class));
        callbackImpl.stop();
        return result;
    }
}

Follow these guidelines when programming the JWS file that invokes the target web service; code snippets of the guidelines are shown in bold in the preceding example:

- Import the packages required to access the servlet context, publish the web service endpoint, and access the TargetService stub implementation.

```java
import javax.xml.ws.Endpoint;
import javax.xml.ws.WebServiceContext;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.wsaddressing.W3CEndpointReference;
import examples.webservices.callback.target.*;
```

- Get the servlet context using the WebServiceContext and MessageContext. You will use the servlet context when publishing the web service endpoint, later.

```java
@Resource
private WebServiceContext context;
```
Object sc
    context.getMessageContext().get(MessageContext.SERVLET_CONTEXT);

For more information about accessing runtime information using WebServiceContext and MessageContext, see Section 4.4, "Accessing Runtime Information About a Web Service."

- Create a web service endpoint to the CallbackService implementation and publish that endpoint to accept incoming requests.

    Endpoint callbackImpl = Endpoint.create(new CallbackWS());
    callbackImpl.publish(sc);

    For more information about web service publishing, see Chapter 28, "Publishing a Web Service Endpoint."

- Access an instance of the TargetService stub implementation and invoke the targetOperation operation of TargetService using the port you instantiated. You pass the CallbackService service endpoint as a javax.xml.ws.wsaddressing.W3CEndpointReference data type:

    @WebServiceRef()
    private TargetService target;

    TargetPortType tPort = target.getTargetPort();
    String result = tPort.targetOperation(s,
            callbackImpl.getEndpointReference(W3CEndpointReference.class));

- Stop publishing the endpoint:

    callbackImpl.stop();

### 26.6 Programming Guidelines for the Callback Web Service

The following example shows a simple JWS file for a callback web service. The callback operation is shown in bold.

```java
package examples.webservices.callback;

import javax.jws.WebService;
import javax.xml.ws.BindingType;

@WebService(
    portName="CallbackPort",
    serviceName="CallbackService",
    targetNamespace="http://example.oracle.com",
    endpointInterface=  
    "examples.webservices.callback.callbackservice.CallbackPortType",
    wsdlLocation="/wsdls/Callback.wsdl")
@BindingType(value="http://schemas.xmlsoap.org/wsdl/soap/http")

public class CallbackWS implements 
examples.webservices.callback.callbackservice.CallbackPortType {
```
Updating the build.xml File for the Target Web Service

26.7 Updating the build.xml File for the Target Web Service

You update a build.xml file to generate a target web service that invokes the callback web service by adding taskdefs and a build-target target that resemble the following example. See the description after the example for details.

```xml
<taskdef name="jwsc"
classname="weblogic.wsee.tools.anttasks.JwscTask" />
<target name="build-target">
  <jwsc srcdir="src" destdir="${ear-dir}" listfiles="true">
    <jws file="TargetImpl.java" compiledWsdl="${cowDir}/target/Target_wsdl.jar" type="JAXWS">
      <WLHttpTransport contextPath="target" serviceUri="TargetService"/>
    </jws>
    <clientgen type="JAXWS" wsdl="Callback.wsdl" packageName="examples.webservices.callback.callbackservice"/>
  </jwsc>
  <zip destfile="${ear-dir}/jws.war" update="true">
    <zipfileset dir="src/examples/webservices/callback" prefix="wsdls">
      <include name="Callback*.wsdl"/>
    </zipfileset>
  </zip>
</target>
```

Use the taskdef Ant task to define the full classname of the jwsc Ant tasks. Update the jwsc Ant task that compiles the client web service to include:

- `<clientgen>` child element of the `<jws>` element to generate and compile the Service interface stubs for the deployed CallbackService web service. The jwsc Ant task automatically packages them in the generated WAR file so that the client web service can immediately access the stubs. You do this because the TargetImpl JWS file imports and uses one of the generated classes.
- `<zip>` element to include the WSDL for the CallbackService service in the WAR file so that other web services can access the WSDL from the following URL: http://${wls.hostname}:${wls.port}/callback/wsdls/Callback.wsdl.

For more information about jwsc, see "Running the jwsc WebLogic Web Services Ant Task" in Developing JAX-RPC Web Services for Oracle WebLogic Server.
This chapter highlights the differences between static and dynamic proxy clients, and describes the steps to develop a dynamic proxy client for WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 27.1, "Overview of Static Versus Dynamic Proxy Clients"
- Section 27.2, "Steps to Develop a Dynamic Proxy Client"
- Section 27.3, "Additional Considerations When Specifying WSDL Location"

### 27.1 Overview of Static Versus Dynamic Proxy Clients

<table>
<thead>
<tr>
<th>Proxy Client Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static proxy client</td>
<td>Compile and bind the web service client at development time. This generates a static stub for the web service client proxy. The source code for the generated static stub client relies on a specific service implementation. As a result, this option offers the least flexibility. For examples of static proxy clients, see:</td>
</tr>
<tr>
<td></td>
<td>■ “Invoking Web Service Clients” in Developing JAX-WS Web Services for Oracle WebLogic Server</td>
</tr>
<tr>
<td></td>
<td>■ Chapter 7, &quot;Roadmap for Developing JAX-WS Web Service Clients”</td>
</tr>
<tr>
<td>Dynamic proxy client</td>
<td>Compile nothing at development time. At runtime, the application retrieves and interprets the WSDL and dynamically constructs calls. A dynamic proxy client enables a web service client to invoke a web service based on a service endpoint interface (SEI) dynamically at run-time (without using clientgen). This option does not rely upon a specific service implementation, providing greater flexibility, but also a greater performance hit. The steps to develop a dynamic proxy client are described in Section 27.2, &quot;Steps to Develop a Dynamic Proxy Client.”</td>
</tr>
</tbody>
</table>

### 27.2 Steps to Develop a Dynamic Proxy Client

The steps to create a dynamic proxy client are outlined in the following table. For more information, see the `javax.xml.ws.Service` Javadoc at http://docs.oracle.com/javaee/7/api/javax/xml/ws/Service.html.
### Additional Considerations When Specifying WSDL Location

If you use HTTPS to get the web service from the WSDL, and the hostname definition in the WebLogic Server SSL certificate does not equal the hostname of the peer HTTPS server or is not one of the following, the action fails with a hostname verification error:

- localhost
- 127.0.0.1
- hostname of localhost
- IP address of localhost

The hostname verification error is as follows:

```java
EchoService service = new EchoService(https-wsdl, webservice-qName);
```

```java
javax.xml.ws.WebServiceException: javax.net.ssl.SSLKeyException:
Security:090504 Certificate chain received from host.company.com - 10.167.194.63
failed hostname verification check. Certificate contained {...} but check expected host.company.com
```

The recommended workaround is to use HTTP instead of HTTPS to get the web service from a WSDL when creating the service, and your own hostname verifier code to verify the hostname after the service is created:

```java
EchoService service = Service.create(http_wsdl, qname);
```

### 27.3 Additional Considerations When Specifying WSDL Location

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create the javax.xml.ws.Service instance.</td>
<td>Create the <code>Service</code> instance using the <code>Service.create()</code> method. You must pass the service name and optionally the location of the WSDL document. The method details are as follows:</td>
</tr>
</tbody>
</table>

```java
public static Service create (QName serviceName) throws javax.xml.ws.WebServiceException {}
public static Service create (URL wsdlDocumentLocation, QName serviceName) throws javax.xml.ws.WebServiceException {}'
```

For example:

```java
URL wsdlLocation = new URL("http://example.org/my.wsdl");
QName serviceName = new QName("http://example.org/sample", "MyService");
Service s = Service.create(wsdlLocation, serviceName);
```

See Section 27.3, "Additional Considerations When Specifying WSDL Location" for additional usage information.

| 2  | Create the proxy stub. | Use the `Service.getPort()` method to create the proxy stub. You can use this stub to invoke operations on the target service endpoint. You must pass the service endpoint interface (SEI) and optionally the name of the port in the WSDL service description. The method details are as follows: |

```java
public <T> T getPort(QName portName, Class<T> serviceEndpointInterface) throws javax.xml.ws.WebServiceException {}
public <T> T getPort(Class<T> serviceEndpointInterface) throws javax.xml.ws.WebServiceException {}'
```

For example:

```java
MyPort port = s.getPort(MyPort.class);
```
EchoPort port = service.getPort(...);
//set self-defined hostname verifier
((BindingProvider) port).getRequestContext().put(
    com.sun.xml.ws.developer.JAXWSProperties.HOSTNAME_VERIFIER,
    new MyHostNameVerifier());
/*
*/

Optionally, you can ignore hostname verification by setting the binding provider property:

((BindingProvider) port).getRequestContext().put(
    BindingProviderProperties.HOSTNAME_VERIFICATION_PROPERTY,
    "true");

However, if you must use HTTPS to get the web service from the WSDL, there are several possible workarounds:

- Turn off hostname verification if you are using the WebLogic Server HTTPS connection. To do this, set the global system property to ignore hostname verification:

  weblogic.security.SSL.ignoreHostnameVerification=true

  The system property does not work for service creation if the connection is a JDK connection or other non-WebLogic Server connection.

- Set your own hostname verifier for the connection before you get the web service from the WSDL, and then use HTTPS to get the web service from the WSDL:

  //set self-defined hostname verifier
  URL url = new URL(https_wsdl);
  HttpsURLConnection connection = (HttpsURLConnection)url.openConnection();
  connection.setHostnameVerifier(new MyHostNameVerifier());
  //then initiate the service
  EchoService service = Service.create(https_wsdl, qname);
  //get port and set self-defined hostname verifier to binding provider
  ...

For the workarounds in which you set your own hostname verifier, an example hostname verifier might be as follows:

public class MyHostNameVerifier implements HostnameVerifier {
    public boolean verify(String hostname, SSLSession session) {
        if (hostname.equals("the host you want"))
            return true;
        else
            return false;
    }
}

This chapter describes how to create a web service endpoint at runtime without deploying the web service to a WebLogic Server instance using the javax.xml.ws.Endpoint API.

For more information, see http://docs.oracle.com/javaee/7/api/javax/xml/ws/Endpoint.html.

The following table summarizes the steps to publish a web service endpoint.

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1  | Create a web service endpoint.            | Use the javax.xml.ws.Endpoint create() method to create the endpoint, specify the implementor (that is, the web service implementation) to which the endpoint is associated, and optionally specify the binding type. If not specified, the binding type defaults to SOAP1.1/HTTP. The endpoint is associated with only one implementation object and one javax.xml.ws.Binding, as defined at runtime; these values cannot be changed. For example, the following example creates a web service endpoint for the CallbackWS() implementation.
   
   ```java
   Endpoint callbackImpl = Endpoint.create(new CallbackWS());
   ``` |
| 2  | Publish the web service endpoint to accept incoming requests. | Use the javax.xml.ws.Endpoint publish() method to specify the server context, or the address and optionally the implementor of the web service endpoint. **Note:** If you wish to update the metadata documents (WSDL or XML schema) associated with the endpoint, you must do so before publishing the endpoint. For example, the following example publishes the web service endpoint created in Step 1 using the server context.
   
   ```java
   Object sc = context.getMessageContext().get(MessageContext.SERVLET_CONTEXT);
   callbackImpl.publish(sc);
   ``` |
For an example of publishing a web service endpoint within the context of a callback example, see Section 26.5, "Programming Guidelines for the Callback Client Web Service".

In addition to the steps described in the previous table, you can defined the following using the `javax.xml.ws.Endpoint` API methods:

- Endpoint metadata documents (WSDL or XML schema) associated with the endpoint. You must define metadata before publishing the web service endpoint.
- Endpoint properties.
- `java.util.concurrent.Executor` that will be used to dispatch incoming requests to the application (see [http://docs.oracle.com/javase/8/docs/api/java/util/concurrent/Executor.html](http://docs.oracle.com/javase/8/docs/api/java/util/concurrent/Executor.html)).

For more information, see the `javax.xml.ws.Endpoint` Javadoc at [http://docs.oracle.com/javaee/7/api/javax/xml/ws/Endpoint.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/Endpoint.html).

---

**Table 28–1 (Cont.) Steps to Publish a Web Service Endpoint**

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 3  | Stop the web service endpoint to shut it down and prevent additional requests after processing is complete. | Use the `javax.xml.ws.Endpoint.stop()` method to shut down the endpoint and stop accepting incoming requests. Once stopped, an endpoint cannot be republished.  
For example:  
callbackImpl.stop() |
This chapter describes how to use XML catalogs with WebLogic web services using Java API for XML Web Services (JAX-WS).

This chapter includes the following sections:

- Section 29.1, "Overview of XML Catalogs"
- Section 29.2, "Defining and Referencing XML Catalogs"
- Section 29.3, "Disabling XML Catalogs in the Client Runtime"
- Section 29.4, "Getting a Local Copy of XML Resources"

### 29.1 Overview of XML Catalogs

An XML catalog enables your application to reference imported XML resources, such as WSDLs and XSDs, from a source that is different from that which is part of the description of the web service. Redirecting the XML resources in this way may be required to improve performance or to ensure your application runs properly in your local environment.

For example, a WSDL may be accessible during client generation, but may no longer be accessible when the client is run. You may need to reference a resource that is local to or bundled with your application rather than a resource that is available over the network. Using an XML catalog file, you can specify the location of the WSDL that will be used by the web service at runtime.

The following table summarizes how XML catalogs are supported in the WebLogic Server Ant tasks.
The following sections describe how to:

- Define and reference an XML catalog to specify the XML resources that you want to redirect. See Section 29.2, "Defining and Referencing XML Catalogs".
- Disable XML catalogs in the client runtime. See Section 29.3, "Disabling XML Catalogs in the Client Runtime".
- Get a local copy of the WSDL and its imported XML resources using `wsdlget`. These files can be packaged with your application and referenced from within an XML catalog. See Section 29.4, "Getting a Local Copy of XML Resources".

For more information about XML catalogs, see the Oasis XML Catalogs specification at http://www.oasis-open.org/committees/download.php/14809/xml-catalogs.html.

### Table 29–1  Support for XML Catalogs in WebLogic Server Ant Tasks

<table>
<thead>
<tr>
<th>Ant Task</th>
<th>Description</th>
</tr>
</thead>
</table>
| clientgen | Define and reference XML catalogs in one of the following ways:  
- Use the `catalog` attribute to specify the name of the external XML catalog file. For more information, see Section 29.2.1, "Defining an External XML Catalog".  
- Use the `<xmlcatalog>` child element to reference an embedded XML catalog file. For more information, see Section 29.2.2, "Embedding an XML Catalog".  

When you execute the `clientgen` Ant task to build the client (or the `jwsc` Ant task if the `clientgen` task is embedded), the `jax-ws-catalog.xml` file is generated and copied to the client runtime environment. The `jax-ws-catalog.xml` file contains the XML catalog(s) that are defined in the external XML catalog file(s) and/or embedded in the `build.xml` file. This file is copied, along with the referenced XML targets, to the `META-INF` or `WEB-INF` folder for Enterprise or Web applications, respectively.  

**Note:** The contents of the XML resources are not impacted during this process.  

You can disable the `jax-ws-catalog.xml` file from being copied to the client runtime environment, as described in Section 29.3, "Disabling XML Catalogs in the Client Runtime". |
| wsdlc | Define and reference XML catalogs in one of the following ways:  
- Use the `catalog` attribute to specify the name of the external XML catalog file. For more information, see Section 29.2.1, "Defining an External XML Catalog".  
- Use the `<xmlcatalog>` child element to reference an embedded XML catalog file. For more information, see Section 29.2.2, "Embedding an XML Catalog".  

When you execute the `wsdlc` Ant task, the XML resources are copied to the compiled WSDL JAR file or exploded directory. |
| wsdlget | Define and reference XML catalogs in one of the following ways:  
- Use the `catalog` attribute to specify the name of the external XML catalog file. For more information, see Section 29.2.1, "Defining an External XML Catalog".  
- Use the `<xmlcatalog>` child element to reference an embedded XML catalog file. For more information, see Section 29.2.2, "Embedding an XML Catalog".  

When you execute the `wsdlget` Ant task, the WSDL and imported resources are downloaded to the specified directory.  

**Note:** The contents of the XML resources are updated to reference the resources defined in the XML catalog(s). |
29.2 Defining and Referencing XML Catalogs

You define an XML catalog and then reference it from the `clientgen` or `wsdlc` Ant task in your `build.xml` file in one of the following ways:

- **Define an external XML catalog** - Define an external XML catalog file and reference that file from the `clientgen` or `wsdlc` Ant tasks in your `build.xml` file using the `catalogs` attribute. For more information, see Section 29.2.1, "Defining an External XML Catalog".

- **Embed an XML catalog** - Embed the XML catalog directly in the `build.xml` file using the `<xmlcatalog>` element and reference it from the `clientgen` or `wsdlc` Ant tasks in your `build.xml` file using the `<xmlcatalog>` child element. For more information, see Section 29.2.2, "Embedding an XML Catalog".

In the event of a conflict, entries defined in an embedded XML catalog take precedence over those defined in an external XML catalog.

---

**Note:** You can use the `wsdlget` Ant task to get a local copy of the XML resources, as described in Section 29.3, "Disabling XML Catalogs in the Client Runtime".

---

29.2.1 Defining an External XML Catalog

To define an external XML catalog:

1. Create an external XML catalog file that defines the XML resources that you want to be redirected. See Section 29.2.1.1, "Creating an External XML Catalog File".

2. Reference the XML catalog file from the `clientgen` or `wsdlc` Ant task in your `build.xml` file using the `catalogs` attribute. See Section 29.2.1.2, "Referencing the External XML Catalog File".

Each step is described in more detail in the following sections.

29.2.1.1 Creating an External XML Catalog File

The `<catalog>` element is the root element of the XML catalog file and serves as the container for the XML catalog entities. To specify XML catalog entities, you can use the `system` or `public` elements, for example.

The following provides a sample XML catalog file:

```xml
<catalog xmlns="urn:oasis:names:tc:entity:xmlns:xml:catalog"
         prefer="system">
  <system systemId="http://foo.org/hello?wsdl"
          uri="HelloService.wsdl" />
  <public publicId="ISO 8879:1986//ENTITIES Added Latin 1//EN"
          uri="wsdl/myApp/myApp.wsdl"/>
</catalog>
```

In the above example:

- The `<catalog>` root element defines the XML catalog namespace and sets the `prefer` attribute to `system` to specify that system matches are preferred.
- The `<system>` element associates a URI reference with a system identifier.
- The `<public>` element associates a URI reference with a public identifier.

### 29.2.1.2 Referencing the External XML Catalog File

To reference the XML catalog file from the `clientgen` or `wsdlc` Ant task in your `build.xml` file, use the `catalogs` attribute.

The following example shows how to reference an XML catalog file using `clientgen`. Relevant code lines are shown in **bold**.

```xml
<target name="clientgen">

  <clientgen
    type="JAXWS"
    wsdl="${wsdl}"
    destDir="${clientclasses.dir}"
    packageName="xmlcatalog.jaxws.clientgen.client"
    catalogs="wsdlcatalog.xml"/>

</target>
```

### 29.2.2 Embedding an XML Catalog

To embed an XML catalog:

1. Create an embedded XML catalog in the `build.xml` file. See Section 29.2.2.1, "Creating an Embedded XML Catalog".

2. Reference the embedded XML catalog from the `clientgen` or `wsdlc` Ant task using the `<xmlcatalog>` child element. See Section 29.2.2.2, "Referencing an Embedded XML Catalog".

Each step is described in more detail in the following sections.

---

**Note:** In the event of a conflict, entries defined in an embedded XML catalog take precedence over those defined in an external XML catalog.

---

#### 29.2.2.1 Creating an Embedded XML Catalog

The `<xmlcatalog>` element enables you to embed an XML catalog directly in the `build.xml` file. The following shows a sample of an embedded XML catalog in the `build.xml` file.

```xml
<xmlcatalog id="wsimportcatalog">
  <entity publicid="http://helloservice.org/types/HelloTypes.xsd"
         location="${basedir}/HelloTypes.xsd"/>
</xmlcatalog>
```


#### 29.2.2.2 Referencing an Embedded XML Catalog

The `<xmlcatalog>` child element of the `clientgen` or `wsdlc` Ant tasks enables you to reference an embedded XML catalog. To specify the `<xmlcatalog>` element, use the following syntax:
Disabling XML Catalogs in the Client Runtime

The id referenced by the <xmlcatalog> child element must match the ID of the embedded XML catalog.

The following example shows how to reference an embedded XML catalog using clientgen. Relevant code lines are shown in bold.

```xml
<target name="clientgen">
  <clientgen
    type='JAXWS'
    wsdl='${wsdl}'
    destDir='${clientclasses.dir}'
    packageName='xmlcatalog.jaxws.clientgen.client'
    catalog='wsdlcatalog.xml'/>
  <xmlcatalog refid="wsimportcatalog"/>
</clientgen>
</target>
<xmlcatalog id="wsimportcatalog">
  <entity publicid="http://helloservice.org/types/HelloTypes.xsd"
    location="${basedir}/HelloTypes.xsd"/>
</xmlcatalog>
```

### 29.3 Disabling XML Catalogs in the Client Runtime

By default, when you define and reference XML catalogs in your build.xml file, as described in Section 29.2, "Defining and Referencing XML Catalogs", when you execute the clientgen Ant task to build the client, the jax-ws-catalog.xml file is generated and copied to the client runtime environment. The jax-ws-catalog.xml file contains the XML catalog(s) that are defined in the external XML catalog file(s) and/or embedded in the build.xml file. This file is copied, along with the referenced XML targets, to the META-INF or WEB-INF folder for Enterprise or Web applications, respectively.

You can disable the generation of the XML catalog artifacts in the client runtime environment by setting the genRuntimeCatalog attribute of the clientgen to false. For example:

```xml
<clientgen
  type='JAXWS'
  wsdl='${wsdl}'
  destDir='${clientclasses.dir}'
  packageName='xmlcatalog.jaxws.clientgen.client'
  catalog='wsdlcatalog.xml'
  genRuntimeCatalog="false"/>
```

In this case, the jax-ws-catalog.xml file will not be copied to the runtime environment.

If you generated your client with the genRuntimeCatalog attribute set to false, to subsequently enable the XML catalogs in the client runtime, you will need to create the jax-ws-catalog.xml file manually and copy it to the META-INF or WEB-INF folder for Enterprise or Web applications, respectively. Ensure that the jax-ws-catalog.xml file contains all of the entries defined in the external XML catalog file(s) and/or embedded in the build.xml file.
29.4 Getting a Local Copy of XML Resources

The `wsdlget` Ant task enables you to get a local copy of XML resources, such as WSDL and XSD files. Then, you can refer to the local version of the XML resources using an XML catalog, as described in Section 29.2, "Defining and Referencing XML Catalogs".

The following excerpt from an Ant `build.xml` file shows how to use the `wsdlget` Ant task to download a WSDL and its XML resources. The XML resources will be saved to the `wsdl` folder in the directory from which the Ant task is run.

```xml
<target name="wsdlget">
  <wsdlget
    wsdl="http://host/service?wsdl"
    destDir="/wsdl/"
  />
</target>
```
This chapter describes how to program web services using XML over HTTP. This chapter includes the following sections:

- **Section 30.1, "About Programming Web Services Using XML Over HTTP"
- **Section 30.2, "Programming Guidelines for the Web Service Using XML Over HTTP"
- **Section 30.3, "Accessing the Web Service from a Client"
- **Section 30.4, "Securing Web Services that Use XML Over HTTP"

### 30.1 About Programming Web Services Using XML Over HTTP

In addition to standard "SOAP over HTTP" use cases, WebLogic JAX-WS can also be used for some "XML over HTTP" web services. Use of the XML over HTTP style allows you to build simple RESTful web services while still leveraging the convenience of the JAX-WS programming model.

---

**Note:** As a best practice, it is recommended that you develop RESTful web services using the Jersey JAX-RS RI, as described in *Developing and Securing RESTful Web Services for Oracle WebLogic Server*. The Jersey JAX-RS RI provides an open source, production quality RI for building RESTful web services and supports all of the HTTP methods.

---

When using the HTTP protocol to access web service resources, the resource identifier is the URL of the resource and the standard operation to be performed on that resource is one of the HTTP methods: GET, PUT, DELETE, POST, or HEAD.
You build RESTful-like endpoints using the `invoke()` method of the `javax.xml.ws.Provider<T>` interface (see [http://docs.oracle.com/javaee/7/api/javax/xml/ws/Provider.html](http://docs.oracle.com/javaee/7/api/javax/xml/ws/Provider.html)). The `Provider` interface provides a dynamic alternative to building an service endpoint interface (SEI).

The procedure in this section describes how to program and compile the JWS file required to implement web services using XML over HTTP. The procedure shows how to create the JWS file from scratch; if you want to update an existing JWS file, you can also use this procedure as a guide.

It is assumed that you have set up an Ant-based development environment and that you have a working `build.xml` file to which you can add targets for running the `jwsc` Ant task and deploying the web services. For more information, see Chapter 3, "Developing JAX-WS Web Services."

### Table 30–1 Steps to Program RESTful Web Services

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create a new JWS file, or update an existing one, that implements the web service using XML over HTTP.</td>
<td>Use your favorite IDE or text editor. See Section 30.2, &quot;Programming Guidelines for the Web Service Using XML Over HTTP&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>Update your <code>build.xml</code> file to include a call to the <code>jwsc</code> Ant task to compile the JWS file into a web service.</td>
<td>For example: <code>&lt;jwsc srcdir='.' destdir='output/restEar'&gt; &lt;jws file='NearbyCity.java' type=&quot;JAXWS&quot;/&gt; &lt;/jwsc&gt;</code> For more information, see Section 3.6, &quot;Running the <code>jwsc</code> WebLogic Web Services Ant Task.”</td>
</tr>
<tr>
<td>3</td>
<td>Run the Ant target to build the web service.</td>
<td>For example: <code>prompt&gt; ant build-rest</code></td>
</tr>
<tr>
<td>4</td>
<td>Deploy the web service as usual.</td>
<td>See Section 3.9, &quot;Deploying and Undeploying WebLogic Web Services.”</td>
</tr>
<tr>
<td>5</td>
<td>Access the web service from your web service client.</td>
<td>See Section 30.3, &quot;Accessing the Web Service from a Client&quot;.</td>
</tr>
</tbody>
</table>

### 30.2 Programming Guidelines for the Web Service Using XML Over HTTP

The following example shows a simple JWS file that implements a web service using XML over HTTP; see the explanation after the example for coding guidelines that correspond to the Java code in **bold**.

```java
package examples.webservices.jaxws.rest;
import javax.xml.ws.WebServiceProvider;
```

**Note:** In this JAX-WS implementation, the set of supported HTTP methods is limited to GET and POST. DELETE, PUT, and HEAD are not supported. Any HTTP requests containing these methods will be rejected with a 405 Method Not Allowed error.

If the functionality of PUT and DELETE are required, the desired action can be accomplished by tunneling the actual method to be executed on the POST method. This is a workaround referred to as overloaded POST. (A Web search on "REST overloaded POST" will return a number of ways to accomplish this.)
import javax.xml.ws.BindingType;
import javax.xml.ws.Provider;
import javax.xml.ws.WebServiceContext;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.http.HTTPBinding;
import javax.xml.ws.http.HTTPException;
import javax.xml.transform.Source;
import javax.xml.transform.stream.StreamSource;
import javax.annotation.Resource;
import java.io.ByteArrayInputStream;
import java.util.StringTokenizer;

@WebServiceProvider(targetNamespace="http://example.org",
    serviceName = "NearbyCityService")
@BindingType(value = HTTPBinding.HTTP_BINDING)
public class NearbyCity implements Provider<Source> {

    @Resource(type=Object.class)
    protected WebServiceContext wsContext;

    public Source invoke(Source source) {
        try {
            MessageContext messageContext = wsContext.getMessageContext();

            // Obtain the HTTP method of the input request.
            javax.servlet.http.HttpServletRequest servletRequest =
                (javax.servlet.http.HttpServletRequest)messageContext.get(
                    MessageContext.SERVLET_REQUEST);
            String httpMethod = servletRequest.getMethod();
            if (httpMethod.equalsIgnoreCase("GET")) {
                String query =
                    (String)messageContext.get(MessageContext.QUERY_STRING);
                if (query != null && query.contains("lat=") &&
                    query.contains("long=")) {
                    return createSource(query);
                } else {
                    System.err.println("Query String = "+query);
                    throw new HTTPException(404);
                }
            } catch(Exception e) {
                    e.printStackTrace();
                    throw new HTTPException(500);
            } else {
                // This operation only supports "GET"
                throw new HTTPException405);
            }

        } catch(Exception e) {
            e.printStackTrace();
            throw new HTTPException(500);
        }
    }

    private Source createSource(String str) throws Exception {
        StringTokenizer st = new StringTokenizer(str, "=&/");
        String latLong = st.nextToken();
        double latitude = Double.parseDouble(st.nextToken());
        latLong = st.nextToken();
        double longitude = Double.parseDouble(st.nextToken());
        City nearby = City.findNearBy(latitude, longitude);
        String body = nearby.toXML();
        return new StreamSource(new ByteArrayInputStream(body.getBytes()));
    }
}
Follow these guidelines when programming the JWS file that implements the web service using XML over HTTP. Code snippets of the guidelines are shown in **bold** in the preceding example.

- Import the packages required to implement the Provider web service.
import javax.xml.ws.WebServiceProvider;
import javax.xml.ws.BindingType;
import javax.xml.ws.Provider;

■ Annotate the Provider implementation class and set the binding type to HTTP.

@WebServiceProvider(
    targetNamespace="http://example.org",
    serviceName = "NearbyCityService")
@BindingType(value = HTTPBinding.HTTP_BINDING)

■ Implement the invoke() method of the Provider interface.

public class NearbyCity implements Provider<Source> {
    @Resource(type=Object.class)
    protected WebServiceContext wsContext;

    public Source invoke(Source source) {
        ...
    }

    ■ Get the request string using the QUERY_STRING field in the
    javax.xml.ws.handler.MessageContext for processing (see message URL
    http://docs.oracle.com/javaee/7/api/javax/xml/ws/handler/MessageContext
    .html). The query string is then passed to the createSource() method that returns
    the city, state, longitude, and latitude that is closest to the specified values.
    String query =
        (String)messageContext.get(MessageContext.QUERY_STRING);

30.3 Accessing the Web Service from a Client

To access the web service from a web service client, use the resource URI. For example:

URL url = new URL
    (http://localhost:7001/NearbyCity/NearbyCityService?lat=35&long=-120);
HttpURLConnection conn = (HttpURLConnection)url.openConnection();
connection.setRequestMethod("POST");
// Get result
InputStream is = connection.getInputStream();

In this example, you set the latitude (lat) and longitude (long) values, as required, to
access the required resource.

30.4 Securing Web Services that Use XML Over HTTP

You can secure web services that use XML over HTTP using the same methods that
you use to secure Web applications. For more information, see "Options for Securing
Web Application and EJB Resources" in Securing Resources Using Roles and Policies for
Oracle WebLogic Server.
This chapter describes how you can develop WebLogic web services using Java API for XML Web Services (JAX-WS) that interact with an Oracle database.

This chapter includes the following sections:

- Overview of Stateful Web Services
- Accessing HTTP Session on the Server
- Enabling HTTP Session on the Client
- Developing Stateful Services in a Cluster Using Session State Replication
- A Note About the JAX-WS RI @Stateful Extension

31.1 Overview of Stateful Web Services

Normally, a JAX-WS web service is stateless: that is, none of the local variables and object values that you set in the web service object are saved from one invocation to the next. Even sequential requests from a single client are treated each as independent, stateless method invocations.

There are web service use cases where a client may want to save data on the service during one invocation and then use that data during a subsequent invocation. For example, a shopping cart object may be added to by repeated calls to the addToCart web method and then fetched by the getCart web method. In a stateless web service, the shopping cart object would always be empty, no matter how many addToCart methods were called. But by using HTTP Sessions to maintain state across web service invocations, the cart may be built up incrementally, and then returned to the client.

Enabling stateful support in a JAX-WS web service requires a minimal amount of coding on both the client and server.

31.2 Accessing HTTP Session on the Server

On the server, every web service invocation is tied to an HttpSession object. This object may be accessed from the web service Context that, in turn, may be bound to the web service object using resource injection. Once you have access to your HttpSession object, you can "hang" off of it any stateful objects you want. The next time your client calls the web service, it will find that same HttpSession object and be able to lookup the objects previously stored there. Your web service is stateful!

The steps required on the server:
Enabling HTTP Session on the Client

1. Add the @Resource (defined by Common Annotations for the Java Platform, JSR 250) to the top of your web service.
2. Add a variable of type WebServiceContext that will have the context injected into it.
3. Using the web service context, get the HttpSession object.
4. Save objects in the HttpSession using the setAttribute method and retrieve saved object using getAttribute. Objects are identified by a string value you assign.

The following snippet shows its usage:

**Example 31–1 Accessing HTTP Session on the Server**

```java
@WebService
public class ShoppingCart {
    @Resource // Step 1
    private WebServiceContext wsContext; // Step 2
    public int addToCart(Item item) {
        // Find the HttpSession
        MessageContext mc = wsContext.getMessageContext(); // Step 3
        HttpSession session = ((javax.servlet.http.HttpServletRequest)mc.get(MessageContext.SERVLET_REQUEST)).getSession();
        if (session == null)
            throw new WebServiceException("No HTTP Session found");
        // Get the cart object from the HttpSession (or create a new one)
        List<Item> cart = (List<Item>)session.getAttribute("myCart"); // Step 4
        if (cart == null)
            cart = new ArrayList<Item>();
        // Add the item to the cart (note that Item is a class defined
        // in the WSDL)
        cart.add(item);
        // Save the updated cart in the HTTPSession (since we use the same
        // 'myCart' name, the old cart object will be replaced)
        session.setAttribute("myCart", cart);
        // return the number of items in the stateful cart
        return cart.size();
    }
}
```

31.3 Enabling HTTP Session on the Client

The client-side code is quite simple. All you need to do is set the SESSION_MAINTAIN_PROPERTY on the request context. This tells the client to pass back the HTTP Cookies that it receives from the web service. The cookie contains a session ID that allows the server to match the web service invocation with the correct HttpSession, providing access to any saved stateful objects.

**Example 31–2 Enabling HTTP Session on the Client**

```java
ShoppingCart proxy = new CartService().getCartPort();
((BindingProvider)proxy).getRequestContext().put(BindingProvider.SESSION_MAINTAIN_PROPERTY, true);
// Create a new Item object with a part number of '123456' and an item
// count of 4.
Item item = new Item('123456', 4);
// After first call, we'll print '1' (the return value is the number of objects
// in the Cart object)
System.out.println(proxy.addToCart(item));
```
31.4 Developing Stateful Services in a Cluster Using Session State Replication

In a high-availability environment, a JAX-WS web service may be replicated across multiple server instances in a cluster. A stateful JAX-WS web service is supported in this environment through the use of the WebLogic Server HTTP Session State Replication feature. For more information, see "HTTP Session State Replication" in Administering Clusters for Oracle WebLogic Server.

There are a variety of techniques and configuration requirements for setting up a clustered environment using session state replication (for example, supported servers and load balancers, and so on). From the JAX-WS programming perspective, the only new consideration is that the objects you store in the HttpSession using the HttpSession.setAttribute method (as in Example 31–1) must be Serializable. If they are Serializable, then these stateful objects become available to the web service on all replicated web service instances in the cluster, providing both load balancing and failover capabilities for JAX-WS stateful web services.

31.5 A Note About the JAX-WS RI @Stateful Extension

The JAX-WS 2.1 Reference Implementation (RI) contains a vendor extension that supports a different model for stateful JAX-WS web services using the @Stateful annotation. It’s implementation "pins" the state to a particular instance and is not designed to be scalable or fault-tolerant. This feature is not supported for WebLogic Server JAX-WS web services.
This chapter introduces you to the tools available for developing and administering WebLogic web services.

This chapter includes the following sections:

- Testing Web Services
- Monitoring Web Services and Clients
- Using Work Managers to Prioritize Web Services Work and Reduce Stuck Execute Threads

### 32.1 Testing Web Services

You can test basic and advanced features of your web service, such as security, quality of service (QoS), HTTP headers, and so on. You can also perform stress testing of the security features. For information about testing web services using the Web Services Test Client or Fusion Middleware Control Test Web Service page, see "Testing Web Services" in *Administering Web Services*.

### 32.2 Monitoring Web Services and Clients

You can monitor runtime information for web services and clients, such as number of invocations, errors, faults, and so on, using the WebLogic Server Administration Console or WLST.

The following naming convention is used to identify the web service or client in the monitoring pages:

```
<application_name><application_version><service_name><context_path><url_pattern>
```

Where:

- `application_name`—Name of the application that contains the web service or client.
- `application_version`—Version of the application that contains the web service or client.
- `service_name`—Name of the web service or client.
- `context_path`—Context path defined for the web service. For more information, see "Defining the Context Path of a WebLogic Web Service" on page 3-17.
- `url_pattern`—System default or user-defined web service URL pattern. For more information, see "Specifying the Transport Used to Invoke the Web Service" on page 3-17.
32.2.1 Monitoring Web Services

To monitor a web service using the WebLogic Server Administration Console, click on the Deployments node in the left pane and in the Deployments table that appears in the right pane, locate the Enterprise application in which the web service is packaged. Expand the application by clicking the + node; the web services in the application are listed under the Web Services category. Click on the name of the web service and click the Monitoring tab.

Alternatively, click the Deployments node in the left pane, the Monitoring tab that appears in the right pane, and then the Web Service tab. Click on the name of the web service for which you want to view monitoring statistics.

The following table lists the tabs that you can select to monitor web service information. The pages aggregate the statistics of all the servers on which the web service is running.

---

**Note:** For JAX-WS web services, the built-in Ws-Protocol operation displays statistics that are relevant to the underlying WS-* protocols. This information is helpful in evaluating the application performance.

---

### Table 32–1 Monitoring Web Services

<table>
<thead>
<tr>
<th>Click this tab . . .</th>
<th>To view . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring&gt; General</td>
<td>General statistics about the web services, including total error and invocations counts.</td>
</tr>
<tr>
<td>Monitoring&gt; Invocations</td>
<td>Invocation statistics, such as dispatch and execution times and averages.</td>
</tr>
<tr>
<td>Monitoring&gt; WS-Policy</td>
<td>Policies that are attached to the web service, organized into the following categories: authentication, authorization, confidentiality, and integrity.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports</td>
<td>Table listing the web service endpoints (ports). The table provides a summary of information for each port. Click a port name to view more details.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports &gt; General</td>
<td>General statistics about the web service endpoint. The page displays information such as the web service endpoint name, its URI, and its associated web service, Enterprise application, and application module. Error and invocations counts are aggregated for all web service endpoint operations.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports &gt; Invocations</td>
<td>Invocation statistics for the web service endpoint, such as success, fault, and violation counts.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports &gt; Cluster Routing</td>
<td>Cluster routing statistics for the web service endpoint, such as request and response, and routing failures.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports &gt; Make Connection</td>
<td>MakeConnection anonymous endpoints for a web service. For each anonymous endpoint, runtime monitoring information is displayed, such as the number of messages received, the number of messages pending, and so on. You can customize the information that is shown in the table by clicking Customize this table. Click the name of an anonymous endpoint to view more details.</td>
</tr>
<tr>
<td>Monitoring&gt; Ports &gt; Reliable Message</td>
<td>Reliable messaging sequences for a web service. For each reliable messaging sequence, runtime monitoring information is displayed, such as the sequence state, the source and destination servers, and so on. You can customize the information that is shown in the table by clicking Customize this table. Click the sequence ID to view more details.</td>
</tr>
</tbody>
</table>
### 32.2.2 Monitoring Web Service Clients

To monitor a web service client using the WebLogic Server Administration Console, click on the **Deployments** node in the left pane and, in the Deployments table that appears in the right pane, locate the Enterprise application in which the web service client is packaged. Expand the application by clicking the `+` node and click on the application module within which the web service client is located. Click the **Monitoring** tab, then click the **Web Service Clients** tab.

Alternatively, click the **Deployments** node in the left pane, the **Monitoring** tab that appears in the right pane, and then the **Web Service Clients** tab. Click on the name of the web service client for which you want to view monitoring statistics.

The table provides a summary of runtime information for each web service client. Click the client name in the table to view more information.

**Note:** For JAX-WS web services, the web services runtime creates system-defined client instances within a web service endpoint that are used to send protocol-specific messages as required by that endpoint. These client instances are named after the web service endpoint that they serve with the following suffix: `-SystemClient`. Monitoring information relevant to the system-defined client instances is provided to assist in evaluating the application.
32.3 Using Work Managers to Prioritize Web Services Work and Reduce Stuck Execute Threads

After a connection has been established between a client application and a web service, the interactions between the two are ideally smooth and quick, whereby the client makes requests and the service responds in a prompt and timely manner. Sometimes, however, a client application might take a long time to make a new request, during which the web service waits to respond, possibly for the life of the WebLogic Server instance; this is often referred to as a stuck execute thread. If, at any given moment, WebLogic Server has a lot of stuck execute threads, the overall performance of the server might degrade.
If a particular web service gets into this state fairly often, you can specify how the service prioritizes the execution of its work by configuring a Work Manager and applying it to the service. For example, you can configure a response time request class (a specific type of Work Manager component) that specifies a response time goal for the web service.

The following shows an example of how to define a response time request class in a deployment descriptor:

```xml
<work-manager>
  <name>responsetime_workmanager</name>
  <response-time-request-class>
    <name>my_response_time</name>
    <goal-ms>2000</goal-ms>
  </response-time-request-class>
</work-manager>
```

You can configure the response time request class using the WebLogic Server Administration Console, as described in "Work Manager: Response Time: Configuration" in Oracle WebLogic Server Administration Console Online Help.

For more information about Work Managers in general and how to configure them for your web service, see "Using Work Managers to Optimize Scheduled Work" in Administering Server Environments for Oracle WebLogic Server.
Part V

Reference

Part V contains the following chapters:

- Appendix A, "Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection"
- Appendix B, "Example Client Wrapper Class for Batching Reliable Messages"
- Appendix C, "Migrating JAX-RPC Web Services and Clients to JAX-WS"
This appendix summarizes the pre-packaged WS-Policy files that support reliable messaging, Make Connection, or both features together, for WebLogic web services using Java API for XML Web Services (JAX-WS).

You cannot change these pre-packaged files. If their values do not suit your needs, you must create your own WS-Policy file. For details, see:

- Section 14.4, "Creating the Web Service Reliable Messaging WS-Policy File"
- Section 12.6.1.1, "Creating the Web Service Make Connection WS-Policy File (Optional)"

For reference information about the reliable messaging and Make Connection policy assertions, see:

- "Web Service Reliable Messaging Policy Assertion Reference" in WebLogic Web Services Reference for Oracle WebLogic Server
- "Web Service Make Connection Policy Assertion Reference" in WebLogic Web Services Reference for Oracle WebLogic Server

The following table summarizes the pre-packaged WS-Policy files. This table also specifies whether the WS-Policy file can be attached at the method level; if the value in this column is no, then the WS-Policy file can be attached at the class level only.
<table>
<thead>
<tr>
<th>Pre-packaged WS-Policy File</th>
<th>Description</th>
<th>Method Level Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DefaultReliability1.2.xml</td>
<td>Specifies policy assertions related to delivery assurance. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.1, &quot;DefaultReliability1.2.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>DefaultReliability1.1.xml</td>
<td>Specifies policy assertions related to quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html</a>. See Section A.2, &quot;DefaultReliability1.1.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>DefaultReliability.xml</td>
<td><strong>Deprecated.</strong> The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 at <a href="http://schemas.xmlsoap.org/ws/2005/02/rm/WS-RMPolicy.pdf">http://schemas.xmlsoap.org/ws/2005/02/rm/WS-RMPolicy.pdf</a>. In this release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration. Specifies typical values for the reliable messaging policy assertions, such as inactivity timeout of 10 minutes, acknowledgement interval of 200 milliseconds, and base retransmission interval of 3 seconds. See Section A.3, &quot;DefaultReliability.xml WS-Policy File (WS-Policy) [Deprecated]&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>LongRunningReliability.xml</td>
<td><strong>Deprecated.</strong> The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 for long running processes. In this release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration. Similar to the preceding default reliable messaging WS-Policy file, except that it specifies a much longer activity timeout interval (24 hours.) See Section A.4, &quot;LongRunningReliability.xml WS-Policy File (WS-Policy) [Deprecated]&quot;.</td>
<td>Yes</td>
</tr>
<tr>
<td>Mc1.1.xml</td>
<td>Enables Make Connection support on the web service and specifies usage as optional on the web service client. The WS-Policy 1.5 protocol is used. See Section A.5, &quot;Mc1.1.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
<tr>
<td>Mc.xml</td>
<td>Enables Make Connection support on the web service and specifies usage as optional on the web service client. The WS-Policy 1.2 protocol is used. See Section A.6, &quot;Mc.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
<tr>
<td>Reliability1.2_ExactlyOnce_WithMC1.1.xml</td>
<td>Specifies policy assertions related to quality of service. It enables Make Connection support on the web service and specifies usage as optional on the web service client. See Section A.7, &quot;Reliability1.2_ExactlyOnce_WithMC1.1.xml (WS-Policy File)&quot;.</td>
<td>No</td>
</tr>
</tbody>
</table>
Table A–1  (Cont.) Pre-packaged WS-Policy Files That Support Reliable Messaging

<table>
<thead>
<tr>
<th>Pre-packaged WS-Policy File</th>
<th>Description</th>
<th>Method Level</th>
<th>Attachment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability1.2_SequenceSTRSecurity</td>
<td>Specifies that in order to secure messages in a reliable sequence, the runtime will use the wase:SecurityTokenReference that is referenced in the CreateSequence message. It enables Make Connection support on the web service and specifies usage as optional on the web service client. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.10, &quot;Reliability1.2_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Reliability1.1_SequenceSTRSecurity</td>
<td>The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html</a>. See Section A.11, &quot;Reliability1.1_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Reliability1.2_SequenceTransportSecurity</td>
<td>Specifies policy assertions related to transport-level security and quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a>. See Section A.10, &quot;Reliability1.2_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Reliability1.1_SequenceTransportSecurity</td>
<td>Specifies policy assertions related to transport-level security and quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html">http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html</a>. See Section A.11, &quot;Reliability1.1_SequenceTransportSecurity.xml (WS-Policy File)&quot;.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Reliability1.0_1.2.xml</td>
<td>Combines 1.2 and 1.0 WS-Reliable Messaging policy assertions. The policy assertions for the 1.2 version Make Connection support on the web service and specifies usage as optional on the web service client. This sample relies on smart policy selection to determine the policy assertion that is applied at runtime. See Section A.12, &quot;Reliability1.0_1.2.xml (WS-Policy File)&quot;.</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Reliability1.0_1.1.xml</td>
<td>Combines 1.1 and 1.0 WS Reliable Messaging policy assertions. See Section A.13, &quot;Reliability1.0_1.1.xml (WS-Policy.xml File)&quot;.</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

A.1 DefaultReliability1.2.xml (WS-Policy File)

The DefaultReliability1.2.xml WS-Policy file specifies policy assertions related to delivery assurance. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.2-spec-os.html.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/2005/08/addressing">
  <wsp15:All>
    <wsrm:RMAssertion
      xmlns:wsrm="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
      <wsrm:DeliveryAssurance>
        <wsp15:Policy>
          <wsrm:ExactlyOnce/>
        </wsp15:Policy>
      </wsrm:DeliveryAssurance>
    </wsrm:RMAssertion>
  </wsp15:All>
</wsp15:Policy>
```

Pre-packaged WS-Policy Files for Web Services Reliable Messaging and Make Connection   A-3
A.2 DefaultReliability1.1.xml (WS-Policy File)

The DefaultReliability1.1.xml WS-Policy file specifies policy assertions related to quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html.

<?xml version="1.0"?>
<wsmp:Policy
 xmlns:wsmp=http://docs.oasis-open.org/ws-rx/wsrmp/200702
 xmlns:beapolicy="http://www.bea.com/wsrm/policy">
<wsmp:RMAssertion
 xmlns:wsrpmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
<wsrpmp:DeliveryAssurance>
<ws:Policy>
<wsrpmp:ExactlyOnce />
</wsp:Policy>
</wsrpmp:DeliveryAssurance>
</wsrpmp:RMAssertion>
</wsp:Policy>

A.3 DefaultReliability.xml WS-Policy File (WS-Policy) [Deprecated]

This WS-Policy file is deprecated. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 at http://schemas.xmlsoap.org/ws/2005/02/rm/policy/. In the current release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration.

The DefaultReliability.xml WS-Policy file specifies typical values for the reliable messaging policy assertions, such as inactivity timeout of 10 minutes, acknowledgement interval of 200 milliseconds, and base retransmission interval of 3 seconds.

<?xml version="1.0"?>
<wsp:Policy
 xmlns:wsm="http://schemas.xmlsoap.org/ws/2005/02/rm/policy"
 xmlns:beapolicy="http://www.bea.com/wsrm/policy">
<wrm:RMAssertion>
<wrm:InactivityTimeout Milliseconds="600000"/>
<wrm:BaseRetransmissionInterval Milliseconds="3000"/>
<wrm:ExponentialBackoff/>
<wrm:AcknowledgementInterval Milliseconds="200"/>
<beapolicy:Expires Expires="P1D" optional="true"/>
A.4 LongRunningReliability.xml WS-Policy File (WS-Policy) [Deprecated]

This WS-Policy file is deprecated. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion Version 1.0 at http://schemas.xmlsoap.org/ws/2005/02/rm/policy/. In the current release, many of the reliable messaging policy assertions are managed through JWS annotations or configuration.

The LongRunningReliability.xml WS-Policy files specifies values that are similar to the DefaultReliability.xml WS-Policy file, except that it specifies a much longer activity timeout interval (24 hours). See Section A.4, "LongRunningReliability.xml WS-Policy File (WS-Policy) [Deprecated]."

```xml
<?xml version="1.0"?
<wsp:Policy
xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm/policy"
xmlns:beapolicy="http://www.bea.com/wsrm/policy"
>
<wrm:RMAssertion>
<wrm:InactivityTimeout Milliseconds="86400000" />
<wrm:BaseRetransmissionInterval Milliseconds="3000" />
<wrm:ExponentialBackoff />
<wrm:AcknowledgementInterval Milliseconds="200" />
<beapolicy:Expires Expires="P1M" optional="true"/>
</wrm:RMAssertion>
</wsp:Policy>
```

A.5 Mc1.1.xml (WS-Policy File)

The Mc1.1.xml WS-Policy file enables Make Connection support on the web service and sets usage as optional on the web service client. In this case, the WS-Policy 1.5 protocol is used. The assertions are based on the Make Connection policy assertion defined at http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.1-spec-os.html.

```xml
<?xml version="1.0"?
<wsp:Policy
xmlns:wsp="http://www.w3.org/ns/ws-policy"
xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702">
<wsmc:MCSupported wsp:Optional="true" />
</wsp:Policy>
```

A.6 Mc.xml (WS-Policy File)

The Mc.xml WS-Policy file enables Make Connection support on the web service and sets usage as optional on the web service client. The assertions are based on the Make Connection policy assertion defined at http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.1-spec-os.html.

```xml
<?xml version="1.0"?
<wsp:Policy>
```
A.7 Reliability1.2_ExactlyOnce_WithMC1.1.xml (WS-Policy File)

The Reliability1.2_ExactlyOnce_WithMC1.1.xml WS-Policy file specifies policy assertions related to quality of service. It enables Make Connection support on the web service and specifies usage as optional on the web service client.

The assertions are based on the following specifications:

- Web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.2-spec-os.html.
- Make Connection assertions are based on the Make Connection policy assertion defined at http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.1-spec-os.html.

<?xml version="1.0" encoding="UTF-8" ?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy">
  <wsp15:All>
    <wsrmp:RMAssertion xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
      <wsrmp:DeliveryAssurance>
        <wsp15:Policy>
          <wsrmp:ExactlyOnce />
        </wsp15:Policy>
      </wsrmp:DeliveryAssurance>
    </wsrmp:RMAssertion>
    <wsmc:MCSupported xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702" wsp15:Optional="true" />
  </wsp15:All>
</wsp15:Policy>

A.8 Reliability1.2_SequenceSTR.xml (WS-Policy File)

The Reliability1.2_SequenceSTR.xml file specifies that in order to secure messages in a reliable sequence, the runtime will use the wsse:SecurityTokenReference that is referenced in the CreateSequence message. It enables Make Connection support on the web service and specifies usage as optional on the web service client.

The assertions are based on the following specifications:

- Web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.2-spec-os.html.
- Make Connection assertions are based on the Make Connection policy assertion defined at http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.1-spec-os.html.

<?xml version="1.0" encoding="UTF-8" ?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy">
  <wsp15:All>
    <wsrmp:RMAssertion xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
      <wsrmp:DeliveryAssurance>
        <wsp15:Policy>
          <wsrmp:ExactlyOnce />
        </wsp15:Policy>
      </wsrmp:DeliveryAssurance>
    </wsrmp:RMAssertion>
    <wsmc:MCSupported xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702" wsp15:Optional="true" />
  </wsp15:All>
</wsp15:Policy>
A.9 Reliability1.1_SequenceSTR.xml (WS-Policy File)

The Reliability1.1_SequenceSTR.xml file specifies that in order to secure messages in a reliable sequence, the runtime will use the wsse:SecurityTokenReference that is referenced in the CreateSequence message. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.1 at http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html.

<?xml version="1.0" encoding="UTF-8"?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy">
  <wsp15:All>
    <wsrmp:RMAssertion
      xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
      <wsrmp:SequenceSTR/>
      <wsrmp:DeliveryAssurance>
        <wsp15:Policy>
          <wsrmp:ExactlyOnce/>
        </wsp15:Policy>
      </wsrmp:DeliveryAssurance>
    </wsrmp:RMAssertion>
  </wsp15:All>
</wsp15:Policy>

A.10 Reliability1.2_SequenceTransportSecurity.xml (WS-Policy File)

The Reliability1.2_SequenceTransportSecurity.xml file specifies policy assertions related to transport-level security and quality of service. The web service reliable messaging assertions are based on WS Reliable Messaging Policy Assertion 1.2 at http://docs.oasis-open.org/ws-rx/wsrm/200702/wsrm-1.2-spec-os.html.

<?xml version="1.0" encoding="UTF-8"?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy">
  <wsp15:All>
    <wsrmp:RMAssertion
      xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
      <wsrmp:SequenceTransportSecurity/>
      <wsrmp:DeliveryAssurance>
        <wsp15:Policy>
          <wsrmp:ExactlyOnce/>
        </wsp15:Policy>
      </wsrmp:DeliveryAssurance>
    </wsrmp:RMAssertion>
  </wsp15:All>
</wsp15:Policy>
A.11 Reliability1.1_SequenceTransportSecurity.xml (WS-Policy File)


```xml
  <wsrmp:RMAssertion xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
    <wsrmp:SequenceTransportSecurity/>
    <wsrmp:DeliveryAssurance>
      <wsp:Policy>
        <wsrmp:ExactlyOnce/>
      </wsp:Policy>
    </wsrmp:DeliveryAssurance>
  </wsrmp:RMAssertion>
</wsp:Policy>
```

A.12 Reliability1.0_1.2.xml (WS-Policy File)

The Reliability1.0_1.2.xml WS-Policy file combines 1.2 and 1.0 WS-Reliable Messaging policy assertions.

This sample relies on smart policy selection to determine the policy assertion that is applied at runtime. For more information about smart policy selection, see Section 14.4.3, "Using Multiple Policy Alternatives".

```xml
<?xml version="1.0" encoding="UTF-8"?>
<wsp15:Policy xmlns:wsp15="http://www.w3.org/ns/ws-policy">
  <wsp15:ExactlyOne>
    <wsp15:All>
      <wsrmp:RMAssertion xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
        <wsrmp:DeliveryAssurance>
          <wsp15:Policy>
            <wsrmp:ExactlyOnce/>
          </wsp15:Policy>
        </wsrmp:DeliveryAssurance>
      </wsrmp:RMAssertion>
      <wsmc:MCSupported xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702" wsp15:Optional="true"/>
    </wsp15:All>
    <wsp15:All>
      <wsrmp10:RMAssertion xmlns:wsrmp10="http://schemas.xmlsoap.org/ws/2005/02/rm/policy">
        <wsrmp10:InactivityTimeout Milliseconds="600000"/>
        <wsrmp10:BaseRetransmissionInterval Milliseconds="3000"/>
        <wsrmp10:ExponentialBackoff/>
        <wsrmp10:AcknowledgementInterval Milliseconds="200"/>
      </wsrmp10:RMAssertion>
    </wsp15:All>
  </wsp15:ExactlyOne>
</wsp15:Policy>
```
A.13 Reliability1.0_1.1.xml (WS-Policy.xml File)

The Reliability1.0_1.1.xml WS-Policy file combines 1.1 and 1.0 WS-Reliable Messaging policy assertions. This sample relies on smart policy selection to determine the policy assertion that is applied at runtime. For more information about smart policy selection, see Section 14.4.3, "Using Multiple Policy Alternatives".

Note: The 1.0 web service reliable messaging assertions are prefixed by wsrmp10.

```xml
  <wsp:ExactlyOne>
    <wsp:All>
      <wsrmp:RMAssertion
        xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702">
        <wsrmp:DeliveryAssurance>
          <wsp:Policy>
            <wsrmp:ExactlyOnce/>
          </wsp:Policy>
        </wsrmp:DeliveryAssurance>
      </wsrmp:RMAssertion>
    </wsp:All>
    <wsp:All>
      <wsrmp10:RMAssertion
        xmlns:wsrmp10="http://schemas.xmlsoap.org/ws/2005/02/rm/policy">
        <wsrmp10:InactivityTimeout Milliseconds="600000"/>
        <wsrmp10:BaseRetransmissionInterval Milliseconds="3000"/>
        <wsrmp10:ExponentialBackoff/>
        <wsrmp10:AcknowledgementInterval Milliseconds="200"/>
      </wsrmp10:RMAssertion>
    </wsp:All>
  </wsp:ExactlyOne>
</wsp:Policy>
```
This appendix provides an example client wrapper class that can be used for batching reliable messaging for WebLogic web services using Java API for XML Web Services (JAX-WS).

For more information about batching reliable messages, see Section 14.11, "Grouping Messages into Business Units of Work (Batching)."

---

**Note:** This client wrapper class is example code only; it is not an officially supported production class.

---

**Example B–1 Example Client Wrapper Class for Batching Reliable Messages**

```java
package example.servlet;

import java.io.PrintStream;
import java.io.PrintWriter;
import java.lang.ref.WeakReference;
import java.lang.reflect.InvocationHandler;
import java.lang.reflect.Proxy;
import java.util.Date;
import java.util.SortedSet;
import java.util.Timer;
import java.util.TimerTask;
import javax.xml.datatype.DatatypeFactory;
import javax.xml.datatype.Duration;
import javax.xml.ws.BindingProvider;
import weblogic.wsee.jaxws.JAXWSProperties;
import weblogic.wsee.jaxws.api.ClientInstance;
import weblogic.wsee.reliability.MessageRange;
import weblogic.wsee.reliability2.api.WsrmClient;
import weblogic.wsee.reliability2.api.WsrmClientFactory;
import weblogic.wsee.reliability2.api.WsrmInvocationPropertyBag;
import weblogic.wsee.reliability2.api.WsrmClientImpl;

/**
 * Example wrapper class to batch reliable requests into fixed size 'batches'
 * that can be sent using a single RM sequence. This class allows a client to
 * send requests that have no natural common grouping or
 * 'business unit of work' and not pay the costs associated with creating and
 */
```
* terminating an RM sequence for every message.
* NOTE: This class is an *example* of how batching might be performed. To do
* batching correctly, you should consider error recovery and how to
* report sequence errors (reported via ReliabilityErrorListener) back
* to the clients that made the original requests.
*  
* If your web service client code knows of some natural business-oriented
* grouping of requests (called a 'business unit of work'), it should make the
* RM subsystem aware of this unit of work by using the
* WsrmClient.setFinalMessage() method to demarcate the end of a unit (just
* before sending the actual final request via an invocation on
* the client instance). In some cases, notably when the client code represents
* an intermediary in the processing of messages, the client code may not be
* aware of any natural unit of work. In the past, if no business unit of work
* could be determined, clients often just created the client instance, sent the
* single current message they had, and then allowed the sequence to terminate.
* This is functionally workable, but very inefficient. These clients pay the
* cost of an RM sequence handshake and termination for every message they send.
* The BatchingRmClientWrapper class can be used to introduce an artificial
* unit of work (a batch) when no natural business unit of work is available.
*  
* Each instance of BatchingRmClientWrapper is a wrapper instance around a
* client instance (port or Dispatch instance). This wrapper can be used to
* obtain a Proxy instance that can be used in place of the original client
* instance. This allows this class to perform batching operations completely
* invisibly from the perspective of the client code.
*  
* This class is used for batching reliable requests into
* batches of a given max size that will survive for a given maximum
* duration. If a batch fills up or times out, it is ended, causing the
* RM sequence it represents to be ended/terminated. The timeout ensures that
* if the flow of incoming requests stops the batch/sequence will still
* end in a timely manner.
* */

class BatchingRmClientWrapper<T> implements InvocationHandler {

    private Class<T> _clazz;
    private int _batchSize;
    private long _maxBatchLifetimeMillis;
    private T _clientInstance;
    private PrintWriter _out;
    private WsrmClient _rmClient;
    private int _numInCurrentBatch;
    private int _batchNum;
    private Timer _timer;
    private boolean _closed;
    private boolean _proxyCreated;

    /**
     * Create a wrapper instance for batching reliable requests into
     * batches of the given max size that will survive for the given maximum
     * duration. If a batch fills up or times out, it is ended, causing the
     * RM sequence it represents to be ended/terminated.
     * @param clientInstance The client instance that acts as the source object
     * for the batching proxy created by the createProxy() method. This
     * is the port/Dispatch instance returned from the call to
     * getPort/createDispatch. The BatchingRmClientWrapper will take over
     * responsibility for managing the interaction with and cleanup of
     * the client instance via the proxy created from createProxy.
     */

Example Client Wrapper Class for Batching Reliable Messages

public BatchingRmClientWrapper(T clientInstance, Class<T> clazz, int batchSize, String maxBatchLifetime, PrintStream out) {
    _clazz = clazz;
    _batchSize = batchSize;
    try {
        if (maxBatchLifetime == null) {
            maxBatchLifetime = "PT5M";
        }
        Duration duration = DatatypeFactory.newInstance().newDuration(maxBatchLifetime);
        _maxBatchLifetimeMillis = duration.getTimeInMillis(new Date());
    } catch (Exception e) {
        throw new RuntimeException(e.toString(), e);
    }
    _clientInstance = clientInstance;
    _out = new PrintWriter(out, true);
    _rmClient = WsrmClientFactory.getWsrmClientFromPort(_clientInstance);
    _closed = false;
    _proxyCreated = false;
    _timer = new Timer(true);
    _timer.schedule(new TimerTask() {
        @Override
        public void run() {
            terminateOrEndBatch();
        }
    }, _maxBatchLifetimeMillis);
}

public T createProxy() {
    if (_proxyCreated) {
        throw new IllegalStateException("Already created the proxy for this BatchingRmClientWrapper instance which wraps the client instance: " + _clientInstance);
    }
    _proxyCreated = true;
    return (T) Proxy.newProxyInstance(getClass().getClassLoader(), new Class[] {
        _clazz,
        BindingProvider.class,
    }, _clientInstance, _batchSize, String maxBatchLifetime, PrintStream out) {
java.io.Closeable.class
}, this);
}

private void terminateOrEndBatch() {
synchronized(_clientInstance) {
  if (_rmClient.getSequenceId() != null) {
    if (terminateBatchAllowed()) {
      _out.println("Terminating batch " + _batchNum + " sequence (" +
                   _rmClient.getSequenceId() + ") for " + _clientInstance);
      try {
        _rmClient.terminateSequence();
      }
      catch (Exception e) {
        e.printStackTrace(_out);
      }
    } else {
      _out.println("Batch " + _batchNum + " sequence (" + _rmClient.getSequenceId() + ")
                    for " + _clientInstance + " timed out but has outstanding requests to send and
                    cannot be terminated now");
    }
  } endBatch();
}
}

/**
 * Check to see if we have acks for all requests sent. If so,
 * we can terminate.
 */
private boolean terminateBatchAllowed() {
  try {
    synchronized(_clientInstance) {
      if (_rmClient.getSequenceId() != null) {
        long maxMsgNum = _rmClient.getMostRecentMessageNumber();
        if (maxMsgNum < 1) {
          // No messages sent, go ahead and terminate.
          return true;
        }
        SortedSet<MessageRange> ranges = _rmClient.getAckRanges();
        long maxAck = -1;
        boolean hasGaps = false;
        long lastRangeUpper = -1;
        for (MessageRange range: ranges) {
          if (lastRangeUpper > 0) {
            if (range.lowerBounds != lastRangeUpper + 1) {
              hasGaps = true;
            }
          } else {
            lastRangeUpper = range.upperBounds;
          }
          maxAck = range.upperBounds;
          return !(hasGaps || maxAck < maxMsgNum);
        }
      }
    }
  }
  catch (Exception e) {
    e.printStackTrace(_out);
  }
  return true;
}
private void endBatch() {
    synchronized(_clientInstance) {
        if (_numInCurrentBatch > 0) {
            _out.println("Ending batch " + _batchNum + " sequence (" + _rmClient.getSequenceId() + ")
                for " + _clientInstance + "...");
        }
        _rmClient.reset();
        _numInCurrentBatch = 0;
        if (!_closed) {
            _timer.schedule(new TimerTask() {
                @Override
                public void run() {
                    terminateOrEndBatch();
                }
            }, _maxBatchLifetimeMillis);
        }
    }
}

public Object invoke(Object proxy, Method method, Object[] args)
    throws Throwable {
    boolean operationInvoke = method.getDeclaringClass() == _clazz;
    boolean closeableInvoke = method.getDeclaringClass() == java.io.Closeable.class;
    boolean endOfBatch = false;
    if (operationInvoke) {
        synchronized(_clientInstance) {
            // Check our batch size
            if (_numInCurrentBatch == 0) {
                _batchNum++;
            }
            endOfBatch = _numInCurrentBatch >= _batchSize - 1;
            if (endOfBatch) {
                _rmClient.setFinalMessage();
            }
            _out.println("Making " + (endOfBatch ? "final " : "") + "invoke " +
                (_numInCurrentBatch+1) + " of batch " + _batchNum + " sequence (" + _
                rmClient.getSequenceId() + ") with operation: " + method.getName());
        }
    } else if (closeableInvoke && method.getName().equals("close")) {
        synchronized(_clientInstance) {
            // Make sure we don’t try to schedule the timer anymore
            _closed = true;
            _timer.cancel();
        }
    }
    Object ret = method.invoke(_clientInstance, args);
    if (operationInvoke) {
        synchronized(_clientInstance) {
            _numInCurrentBatch++;
            if (endOfBatch) {
                endBatch();
            }
        }
    }
}
} }
return ret;
} }
}
This appendix describes how to migrate Java API for XML-based RPC (JAX-RPC) web services and clients to Java API for XML-based Web Services (JAX-WS).

When migrating your JAX-RPC web services, to preserve the original WSDL file, use the top-down approach, starting from a WSDL file, to generate the JAX-WS web service. For more information, see "Developing WebLogic Web Services Starting From a WSDL File: Main Steps" on page 3-13.

**Note:** In some cases, a JAX-RPC feature may not be supported currently by JAX-WS. In this case, the application cannot be migrated unless it is re-architected.

The following table summarizes the topics that are covered.

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<td>Explains how you must re-write your JAX-RPC client to invoke JAX-WS clients.</td>
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</table>
C.1 Setting the Final Context Root of a WebLogic Web Service

You can set the final context root of a WebLogic web service using a variety of methods, as described in “Specifying the Transport Used to Invoke the Web Service” in Developing JAX-RPC Web Services for Oracle WebLogic Server.

As described in this section, when defining a JAX-RPC web service, you can use the @WLXXXTransport JWS annotations to specify the context root. For JAX-WS web services, the @WLXXXTransport JWS annotations are not valid. If used in the JAX-RPC web service, the JWS file needs to be updated to remove the annotations in favor of one of the other methods.

C.2 Using WebLogic-specific Annotations

JAX-WS supports the following WebLogic-specific annotations:

- @Policy
- @Policies
- @SecurityPolicy
- @SecurityPolicies
- @WssConfiguration

All other WebLogic-specific annotations must be removed from your JAX-RPC applications when migrating to JAX-WS. For more information, see “WebLogic-specific Annotations” in WebLogic Web Services Reference for Oracle WebLogic Server.

C.3 Generating a WSDL File

When you run the jwsc file on a JAX-RPC web service, a WSDL file is generated in the specified output directory. For JAX-WS web services, the WSDL file is generated when the service endpoint is deployed. In order to generate a WSDL file in the output directory, you must specify the wsdlOnly attribute of the <jws> child element of the jwsc Ant task. For more information, see ”jwsc” in the WebLogic Web Services Reference for Oracle WebLogic Server.

C.4 Using JAXB Custom Types

JAX-WS uses Java Architecture for XML Binding (JAXB), described at http://jcp.org/en/jsr/detail?id=222, to manage all of the data binding tasks. If your application supports custom types using XMLBeans or Tyler, you will need to modify them to use JAXB. For more information about using JAXB, see Chapter 5, "Using JAXB Data Binding."

C.5 Using EJB 3.0

JAX-WS supports EJB 3.0. JAX-RPC supports EJB 2.1 only.

EJB 3.0 introduced metadata annotations that enable you to automatically generate, rather than manually create, the EJB Remote and Home interface classes and deployment descriptor files needed when implementing an EJB.

For more information about EJB 3.0 bean class requirements and changes from 2.x, see "Programming the Bean File: Requirements and Changes from 2.X" in Developing Enterprise JavaBeans for Oracle WebLogic Server.
C.6 Migrating from RPC Style SOAP Binding

Use of the SOAPBinding.Style.RPC style, although supported, is not recommended with JAX-WS. It is recommended that you change the style to SOAPBinding.Style.DOCUMENT.

C.7 Updating SOAP Message Handlers

Although the SOAP APIs are similar, JAX-RPC SOAP handlers will need to be modified to run with JAX-WS. For more information, see Chapter 25, "Sending and Receiving SOAP Headers."

C.8 Invoking JAX-WS Clients

JAX-RPC clients will need to be re-written as the JAX-RPC and JAX-WS client APIs are completely different. For more information about writing JAX-WS clients, see "Developing Web Service Clients" in Developing JAX-WS Web Services for Oracle WebLogic Server.