BEA WebLogic Server®

Programming Web Services for WebLogic Server

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Introduction and Roadmap

This section describes the contents and organization of this guide—*Programming Web Services for WebLogic Server.*

- "Document Scope and Audience" on page 1-1
- "Guide to This Document" on page 1-2
- "Related Documentation" on page 1-4
- "Samples for the Web Services Developer" on page 1-4
- "Release-Specific WebLogic Web Services Information" on page 1-5
- "Differences Between 8.1 and 9.0 WebLogic Web Services" on page 1-6
- "Summary of WebLogic Web Services Features" on page 1-6
- "Differences Between Beta and GA WebLogic Web Services" on page 1-8

Document Scope and Audience

This document is a resource for software developers who develop WebLogic Web Services. It also contains information that is useful for business analysts and system architects who are evaluating WebLogic Server or considering the use of WebLogic Web Services for a particular application.

The topics in this document are relevant during the design and development phases of a software project. The document also includes topics that are useful in solving application problems that are discovered during test and pre-production phases of a project.

This document does not address production phase administration, monitoring, or performance tuning Web Service topics. For links to WebLogic Server® documentation and resources for these topics, see "Related Documentation" on page 1-4.

It is assumed that the reader is familiar with J2EE and Web Services concepts, the Java programming language, Enterprise Java Beans (EJBs), and Web technologies. This document emphasizes the value-added features provided by WebLogic Web Services and key information about how to use WebLogic Server features and facilities to get a WebLogic Web Service application up and running.

Guide to This Document

This document is organized as follows:

- This chapter, Chapter 1, "Introduction and Roadmap," introduces the organization of this guide and the features of WebLogic Web Services.
- Chapter 2, "Understanding WebLogic Web Services," provides an overview of how WebLogic Web Services are implemented, why they are useful, and the standard specifications that they implement or to which they conform.
- Chapter 3, "Common Web Services Use Cases and Examples," provides a set of common use case and examples of programming WebLogic Web Services, along with step by step instructions on reproducing the example in your own environment.
- Chapter 4, "Iterative Development of WebLogic Web Services," provides procedures for setting up your development environment and iterative programming of a WebLogic Web Service.
- Chapter 5, "Programming the JWS File," provides details about using JWS annotations in a Java file to implement a basic Web Service. The section discusses both standard (JSR-181) JWS annotations as well as WebLogic-specific ones.
- Chapter 6, "Advanced JWS Programming: Implementing Asynchronous Features," discusses how to implement the following advanced features for your Web Service: Web Service reliable messaging, conversational Web Services, buffering, asynchronous request-response, and SOAP message handlers for intercepting the request and response SOAP message.

- Chapter 8, "Data Types and Data Binding," discusses the built-in and user-defined XML Schema and Java data types that are supported by WebLogic Web Services.
- Chapter 9, "Invoking Web Services,"describes how to write a client application (stand-alone or inside a WebLogic Web Service) that invokes a Web Service using the JAX-RPC stubs generated by the WebLogic Web Service Ant task `clientgen`.
- Chapter 10, "Configuring Security," provides information about configuring different types of security for a WebLogic Web Service: message-level (digital signatures and encryption), transport-level (SSL), and access control.
- Chapter 11, "Administering Web Services," provides information about the types of administrative tasks you typically perform with WebLogic Web Services and the different ways you can go about administering them: Administration Console, WebLogic Scripting Tool, and so on.
- Chapter 12, "Publishing and Finding Web Services Using UDDI," describes how to use UDDI to publish and find Web Services.
- Chapter 13, "Upgrading an 8.1 Web Service to 9.0," describes how to upgrade a Web Service built on WebLogic Server 8.1 to run on the new 9.0 Web Services runtime environment.
- Appendix A, "Ant Task Reference," provides reference documentation about the WebLogic Web Services Ant tasks.
- Appendix B, "JWS Annotation Reference,"provides reference information about the JWS annotations (both standard JSR-181 and WebLogic-specific) that you can use in the JWS file that implements your Web Service.
- Appendix C, "Web Service Reliable Messaging Policy Assertion Reference," provides reference information about the policy assertions you can add to a WS-Policy file to configure the Web Service reliable messaging feature of a WebLogic Web Service.
- Appendix D, "Security Policy Assertion Reference," provides reference information about the policy assertions you can add to a WS-Policy file to configure the message-level (digital signatures and encryption) security of a WebLogic Web Service.
- Appendix E, "WebLogic Web Service Deployment Descriptor Element Reference," provides reference information about the elements in the WebLogic-specific Web Services deployment descriptor `weblogic-webservices.xml`.

Related Documentation

This document contains Web Service-specific design and development information.

For comprehensive guidelines for developing, deploying, and monitoring WebLogic Server applications, see the following documents:

- Developing WebLogic Server Applications is a guide to developing WebLogic Server components (such as Web applications and EJBs) and applications.
- Developing Web Applications for WebLogic Server is a guide to developing Web applications, including servlets and JSPs, that are deployed and run on WebLogic Server.
- Programming WebLogic Enterprise Java Beans is a guide to developing EJBs that are deployed and run on WebLogic Server.
- Programming WebLogic XML is a guide to designing and developing applications that include XML processing.
- Deploying WebLogic Server Applications is the primary source of information about deploying WebLogic Server applications. Use this guide for both development and production deployment of your applications.
- Configuring Applications for Production Deployment describes how to configure your applications for deployment to a production WebLogic Server environment.
- Overview of WebLogic Server System Administration is an overview of administering WebLogic Server and its deployed applications.

Samples for the Web Services Developer

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

BEA recommends that you run some or all of the Web Service examples before programming your own application that use Web Services.

Downloading Examples Described in this Guide

Many of the samples described in this guide are available for download from the dev2dev CodeShare site. Each example is self-contained and requires only that you install WebLogic Server, create a domain, and start a server instance. All needed files, such as the JWS file that implements the sample Web Service, the Java client to invoke the Web Service, and the Ant `build.xml` file to build, deploy, and run the example are included in the ZIP file.

Avitek Medical Records Application (MedRec) and Tutorials

MedRec is an end-to-end sample J2EE application shipped with WebLogic Server that simulates an independent, centralized medical record management system. The MedRec application provides a framework for patients, doctors, and administrators to manage patient data using a variety of different clients.

MedRec demonstrates WebLogic Server and J2EE features, and highlights BEA-recommended best practices. MedRec is included in the WebLogic Server distribution, and can be accessed from the Start menu on Windows machines. For Linux and other platforms, you can start MedRec from the `WL_HOME\samples\domains\medrec` directory, where `WL_HOME` is the top-level installation directory for WebLogic Server.

As companion documentation to the MedRec application, BEA provides development tutorials that provide step-by-step procedures for key development tasks, including Web Service-specific tasks. See Application Examples and Tutorials for the latest information.

Web Services Examples in the WebLogic Server Distribution

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

Additional Web Services Examples Available for Download

Additional API examples for download can be found at http://dev2dev.bea.com. These examples include BEA-certified ones, as well as examples submitted by fellow developers.

Release-Specific WebLogic Web Services Information

For release-specific information, see these sections in *WebLogic Server Release Notes*:

- WebLogic Server Features and Changes lists new, changed, and deprecated features.
- WebLogic Server Known and Resolved Issues lists known problems by general release, as well as service pack, for all WebLogic Server APIs, including Web Services.

Differences Between 8.1 and 9.0 WebLogic Web Services

Web Services is one of the most important themes of J2EE 1.4, and thus of WebLogic Server 9.0. J2EE 1.4 introduces a standard Java component model for authoring Web Services with the inclusion of new specifications such as *Implementing Enterprise Web Services* (JSR-921) and *Java API for XML Registries* (JAX-R), as well as the updated JAX-RPC and SAAJ specifications. Because the implementation of Web Services is now a J2EE standard, there have been many changes between 8.1 and 9.0 WebLogic Web Services.

In particular, the programming model used to create WebLogic Web Services has changed to take advantage of the powerful new metadata annotations feature introduced in Version 5.0 of the JDK. In 9.0 you use JWS metadata annotations to annotate a Java file with information that specifies the shape and behavior of the Web Service. These JWS annotations include both the standard ones defined by the *Web Services Metadata for the Java Platform* specification (JSR-181), as well as additional WebLogic-specific ones. This JWS-based programming model is similar to that of WebLogic Workshop 8.1, although in 8.1 the metadata was specified via Javadoc tags. The WebLogic Web Services programming model in 8.1, by contrast, used the many attributes of the Web Service Ant tasks, such as `servicegen`, to specify the shape and behavior of the Web Service. Occasionally programmers had to update the deployment descriptor file (`webservices.xml`) manually to specify characteristics of the Web Service. The new programming model makes implementing Web Services much easier and quicker.

See Chapter 5, "Programming the JWS File," for more information.

Additionally, the runtime environment upon which WebLogic Web Services 9.0 run has been completely rewritten to support the *Implementing Enterprise Web Services*, Version 1.1 (JSR-921), specification. This means that Web Services created in 9.0 are internally implemented differently from those created in 8.1 and both run in completely different runtime environments. The 8.1 runtime environment has been deprecated, although it will continue to be supported for a limited number of future WebLogic Server releases. This means that even though 8.1 WebLogic Web Services run correctly on WebLogic Server 9.0, this may not always be true and BEA recommends that you upgrade the 8.1 Web Services to run in the 9.0 runtime environment.

See "Anatomy of a WebLogic Web Service" on page 2-3 for more information.

Summary of WebLogic Web Services Features

The following list summarizes the main features of WebLogic Web Services and provides links for additional detailed information:

- Programming model based on the new JDK 5.0 metadata annotations feature. The Web Services programming model uses JWS annotations, defined by the Web Services Metadata for the Java Platform specification (JSR-181).

  See Chapter 5, "Programming the JWS File."

- Implementation of the *Web Services for J2EE*, Version 1.1 specification, which defines the standard J2EE runtime architecture for implementing Web Services in Java.

  See "Anatomy of a WebLogic Web Service" on page 2-3.

- Asynchronous, loosely-coupled Web Services that take advantage of the following features, either separately or all together: Web Service reliable messaging, conversations, buffering, asynchronous request-response, and JMS transport.

  See:

  – "Using Web Service Reliable Messaging" on page 6-1
  – "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17
  – "Creating Conversational Web Services" on page 6-25
  – "Creating Buffered Web Services" on page 6-37
  – "Using JMS Transport as the Connection Protocol" on page 7-1

- Digital signatures and encryption of request and response SOAP messages, as specified by the WS-Security specification.

  See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2.

- Use of WS-Policy files for the Web Service reliable messaging and digital signatures/encryption features.

  See "Use of WS-Policy Files for Web Service Reliable Messaging Configuration" on page 6-2 and "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4.

- Data binding between built-in and user-defined XML and Java data types.

  See Chapter 8, "Data Types and Data Binding."

- SOAP message handlers that intercept the request and response SOAP message from an invoke of a Web Service.

  See "Creating and Using SOAP Message Handlers" on page 7-6.

- Ant tasks that handle JWS files, generate a Web Service from a WSDL file, and create the JAX-RPC client classes needed to invoke a Web Service.

  See Appendix A, “Ant Task Reference.”

- Implementation of and conformance with standard Web Services specifications.

  See “Standards Supported by WebLogic Web Services” on page 2-6.

Differences Between Beta and GA WebLogic Web Services

This section describes, at a high-level, the major changes that have occurred between the Beta and GA versions of this release of WebLogic Web Services. The section does not describe new functionality; see “Summary of WebLogic Web Services Features” on page 1-6 for the complete list of Web Service features in this release.

- The programming model has changed so that the JWS files you create are almost always plain Java files. There are *some* cases when you must explicitly implement a stateless session EJB, although these cases are rare. The `jwsc` Ant task almost always creates a Java class-implemented Web Service, packaged in a WAR file. These details, however, are hidden from the programmer.

  See “Anatomy of a WebLogic Web Service” on page 2-3.

- The functionality of the `jwsc` Ant task has changed so that it now compiles all Java code into class files and packages everything into a WAR or JAR file and creates an exploded EAR directory structure. In Beta you had to compile and package everything yourself.

  See “Running the jwsc WebLogic Web Services Ant Task” on page 4-6.

- The `jwsc` Ant task definition has changed from `weblogic.wsee.tools.anttasks.JWSWSEEGenTask` to `weblogic.wsee.tools.anttasks.JwscTask`.

  See “jwsc” on page A-13.

- The `wsdl2service` Ant task (task definition `weblogic.wsee.tools.anttasks.Wsdl2ServiceAntTask`) no longer exists. Programmers should now use the `wsdlc` Ant task (task definition `weblogic.wsee.tools.anttasks.WsdlcTask`) which generates a JWS interface and partial implementation which programmers update with their business code.

  See “Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps” on page 4-4.

- The `javax.jws.security.SecurityRoles|SecurityIdentity` annotations are in a different package: `weblogic.jws.security.SecurityRoles|SecurityIdentity`.

  See "weblogic.jws.security.SecurityRoles" on page B-48 and "weblogic.jws.security.SecurityIdentity" on page B-50.

- When using Web Service reliable messaging, you no longer need to deploy the internal message-driven bean and Web Service used by the Web Services runtime.

  See "Using Web Service Reliable Messaging" on page 6-1.

- The Web Services reliable messaging feature implements a later version of the WS-ReliableMessaging specification. As a result, the schema of the WS-Policy file used to configure reliable messaging has changed.

  Appendix C, "Web Service Reliable Messaging Policy Assertion Reference."

Understanding WebLogic Web Services

The following sections provide an overview of WebLogic Web Services as implemented by WebLogic Server:

- "What Are Web Services?" on page 2-1
- "Why Use Web Services?" on page 2-2
- "Anatomy of a WebLogic Web Service" on page 2-3
- "Roadmap of Common Web Service Development Tasks" on page 2-4
- "Standards Supported by WebLogic Web Services" on page 2-6

What Are Web Services?

A Web Service is a set of functions packaged into a single entity that is available to other systems on a network and can be shared by and used as a component of distributed Web-based applications. The network can be a corporate intranet or the Internet. Other systems, such as customer relationship management systems, order-processing systems, and other existing back-end applications, can call these functions to request data or perform an operation. Because Web Services rely on basic, standard technologies which most systems provide, they are an excellent means for connecting distributed systems together.

Traditionally, software application architecture tended to fall into two categories: monolithic systems such as those that ran on mainframes or client-server applications running on desktops. Although these architectures worked well for the purpose the applications were built to address, they were closed and their functionality could not be easily incorporated into new applications.

Thus the software industry has evolved toward loosely coupled service-oriented applications that interact dynamically over the Web. The applications break down the larger software system into smaller modular components, or shared services. These services can reside on different computers and can be implemented by vastly different technologies, but they are packaged and accessible using standard Web protocols, such as XML and HTTP, thus making them easily accessible by any user on the Web.

This concept of services is not new—RMI, COM, and CORBA are all service-oriented technologies. However, applications based on these technologies require them to be written using that particular technology, often from a particular vendor. This requirement typically hinders widespread integration of the application's functionality into other services on the network. To solve this problem, Web Services are defined to share the following properties that make them easily accessible from heterogeneous environments:

- Web Services are accessed using widely supported Web protocols such as HTTP.
- Web Services describe themselves using an XML-based description language.
- Web Services communicate with clients (both end-user applications or other Web Services) through simple XML messages that can be produced or parsed by virtually any programming environment or even by a person, if necessary.

Why Use Web Services?

Major benefits of Web Services include:

- Interoperability among distributed applications that span diverse hardware and software platforms
- Easy, widespread access to applications through firewalls using Web protocols
- A cross-platform, cross-language data model (XML) that facilitates developing heterogeneous distributed applications

Because you access Web Services using standard Web protocols such as XML and HTTP, the diverse and heterogeneous applications on the Web (which typically already understand XML and HTTP) can automatically access Web Services, and thus communicate with each other.

These different systems can be Microsoft SOAP ToolKit clients, J2EE applications, legacy applications, and so on. They are written in Java, C++, Perl, and other programming languages. Application interoperability is the goal of Web Services and depends upon the service provider's adherence to published industry standards.

Anatomy of a WebLogic Web Service

WebLogic Web Services are implemented according to the Enterprise Web Services 1.1 specification (JSR-921), which defines the standard J2EE runtime architecture for implementing Web Services in Java. The specification also describes a standard J2EE Web Service packaging format, deployment model, and runtime services, all of which are implemented by WebLogic Web Services.

Note: JSR-921 is the 1.1 maintenance release of JSR-109, which was the J2EE 1.3 specification for Web Services. JSR-921 is currently in final release of the JCP (Java Community Process).

The Enterprise Web Services 1.1 specification describes that a J2EE Web Service is implemented by one of the following components:

- A Java class running in the Web container.
- A stateless session EJB running in the EJB container.

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

This programing model takes advantage of the new JDK 5.0 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 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) as well as a set of WebLogic-specific ones.

For more information on the JWS programming model, see Chapter 5, “Programming the JWS File,”

After you create the JWS file, you use the `jwsc` WebLogic Web Service Ant task to compile the JWS file into either a Java class or a stateless session EJB, as described by the Enterprise Web Services 1.1 specification. You typically do not need to decide this backend implementation of the Web Service; the `jwsc` Ant task picks the optimal implementation based on the JWS annotations you have specified in the 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.

If the `jwsc` Ant task implements your Web Service with a Java class, then `jwsc` packages the Web service in a standard Web application WAR file with all the standard WAR artifacts, such as the `web.xml` and `weblogic.xml` deployment descriptor files. The WAR file, however, contains additional artifacts to indicate that it is also a Web Service; these additional artifacts include the `webservices.xml` and `weblogic-webservices.xml` deployment descriptor files, the JAX-RPC data type mapping file, the WSDL file that describes the public contract of the Web Service, and so on.

Similarly, if the `jwsc` Ant task implements your Web Service with a stateless session EJB, then `jwsc` packages the Web Service in a standard EJB JAR file 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.

Note: The `jwsc` Ant task actually creates a stateless EJB *wrapper* around the JWS file; your business logic is still in the Java class that contains the JWS annotations. But because of the EJB wrapper, the task must package the service in an EJB JAR file and the Web Service is considered to be EJB-implemented.

If you want your business logic to reside in the actual EJB, then your JWS file must explicitly implement `javax.ejb.SessionBean`.

In addition to programming the JWS file, you can also configure one or more SOAP message handlers if you need to do additional processing of the request and response SOAP messages used in the invoke of a Web Service operation.

Once you have coded the basic WebLogic Web Service, you can program and configure additional advanced features. These include being able to invoke the Web Service reliably (as specified by the WS-ReliableMessaging specification, dated February 4, 2005) and also specify that the SOAP messages be digitally signed and encrypted (as specified by the WS-Security specification). 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- or Web Service reliable messaging-specific XML elements that describe the security and reliable-messaging configuration, respectively.

Roadmap of Common Web Service Development Tasks

The following table provides a roadmap of common tasks for creating, deploying, and invoking WebLogic Web Services.

Table 2-1 Web Services Tasks

Major Task	Subtasks and Additional Information
Get started.	"Understanding WebLogic Web Services" on page 2-1
	"Anatomy of a WebLogic Web Service" on page 2-3
	"Standards Supported by WebLogic Web Services" on page 2-6
	"Creating a Simple HelloWorld Web Service" on page 3-2
	"Common Web Services Use Cases and Examples" on page 3-1
Iteratively develop a basic WebLogic Web Service.	"Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2
	"Integrating Web Services Into the WebLogic Split Development Directory Environment" on page 4-16
	"Programming the JWS File" on page 5-1
	"Supported Built-In Data Types" on page 8-2
	"Supported User-Defined Data Types" on page 8-6
	"Programming the User-Defined Java Data Type" on page 5-19
	"Throwing Exceptions" on page 5-22
	"Accessing Runtime Information about a Web Service Using the JwsContext" on page 5-10
	"Should You Implement a Stateless Session EJB?" on page 5-16
	"Creating the Basic Ant build.xml File" on page 4-5
	"Running the jwsc WebLogic Web Services Ant Task" on page 4-6
Deploy the Web Service for testing purposes.	"Deploying and Undeploying WebLogic Web Services" on page 4-13
	"Browsing to the WSDL of the Web Service" on page 4-15

Table 2-1 Web Services Tasks

Major Task	Subtasks and Additional Information
Invoke the Web Service.	"Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4
	"Invoking a Web Service from Another Web Service" on page 9-11
	"Invoking a Web Service Using Asynchronous Request-Response" on page 6-17
	"Creating and Using Client-Side SOAP Message Handlers" on page 9-17
	"Using a Client-Side Security WS-Policy File" on page 9-22
Add advanced features to the Web Service.	"Using Web Service Reliable Messaging" on page 6-1
	"Creating Conversational Web Services" on page 6-25
	"Creating Buffered Web Services" on page 6-37
	"Using JMS Transport as the Connection Protocol" on page 7-1
	"Creating and Using SOAP Message Handlers" on page 7-6
Secure the Web Service.	"Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
	"Configuring Transport-Level Security" on page 10-33
	"Configuring Access Control Security: Main Steps" on page 10-35
Upgrade an 8.1 WebLogic Web Service to run in the 9.0 runtime.	"Upgrading an 8.1 Java Class-Implemented WebLogic Web Service to 9.0: Main Steps" on page 13-2
	"Upgrading an 8.1 EJB-Implemented WebLogic Web Service to 9.0: Main Steps" on page 13-9

Standards Supported by WebLogic Web Services

A Web Service requires the following standard specification implementations or conformance:

- A standard programming model used to develop the Web Service.

The WebLogic Web Services programming model uses standard JDK 1.5 metadata annotations, as specified by the *Web Services Metadata for the Java Platform* specification (JSR-181) See "Web Services Metadata for the Java Platform (JSR-181)" on page 2-8.

- A standard implementation hosted by a server on the Web.

  WebLogic Web Services are hosted by WebLogic Server and are implemented using standard J2EE components, as defined by the *Implementing Enterprise Web Services* 1.1 specification (JSR-921, which is the 1.1 maintenance release of JSR-109). See "Enterprise Web Services 1.1" on page 2-9.

- A standard for transmitting data and Web Service invocation calls between the Web Service and the user of the Web Service.

  WebLogic Web Services use Simple Object Access Protocol (SOAP) 1.1 as the message format and HTTP as the connection protocol. See "SOAP 1.1" on page 2-9.

  WebLogic Web Services implement the SOAP with Attachments API for Java 1.2 specification to access any attachments to the SOAP message. See "SAAJ 1.2" on page 2-10.

- A standard for describing the Web Service to clients so they can invoke it.

  WebLogic Web Services use Web Services Description Language (WSDL) 1.1, an XML-based specification, to describe themselves. See "WSDL 1.1" on page 2-10.

  WebLogic Web Services uses WS-Policy to describe additional functionality and requirements not addressed in WSDL 1.1. WebLogic Web Services conform to the WS-Policy and WS-PolicyAttachment specifications when using policies to describe their reliable messaging and security (digital signatures and encryption) functionality. See "WS-Policy 1.0" on page 2-15 and "WS-PolicyAttachment 1.0" on page 2-15.

- A standard for client applications to invoke a Web Service.

  WebLogic Web Services implement the Java API for XML-based RPC (JAX-RPC) 1.1 as part of a client JAR that client applications can use to invoke WebLogic and non-WebLogic Web Services. See "JAX-RPC 1.1" on page 2-12.

- A standard for digitally signing and encrypting the SOAP request and response messages between a client application and the Web Service it is invoking.

  WebLogic Web Services implement the following OASIS Standard 1.0 Web Services Security specifications, dated April 6 2004:

  – Web Services Security: SOAP Message Security

  – Web Services Security: Username Token Profile

– Web Services Security: X.509 Token Profile

For more information, see "Web Services Security (WS-Security) 1.0" on page 2-13.

- A standard way for two Web Services to communicate asynchronously.

  WebLogic Web Services conform to the WS-Addressing 1.0 and WS-ReliableMessaging 1.0 specifications when asynchronous features such as callbacks, addressing, conversations, and Web Service reliable messaging.

- A standard for client applications to find a registered Web Service and to register a Web Service.

  WebLogic Web Services implement two different registration specifications: UDDI 2.0 and JAX-R 1.0.

BEA Implementation of Web Service Specifications

Many specifications that define Web Service standards are written so as to allow for broad use of the specification throughout the industry. Thus the BEA implementation of a particular specification might not cover all possible usage scenarios covered by the specification.

BEA considers interoperability of Web Services platforms to be more important than providing support for all possible edge cases of the Web Services specifications. BEAcomplies with the Basic Profile 1.1 specification from the Web Services Interoperability Organization and considers it to be the baseline for Web Services interoperability. This guide does not necessarily document all of the Basic Profile 1.1 requirements. This guide does, however, document features that are beyond the requirements of the Basic Profile 1.1.

Web Services Metadata for the Java Platform (JSR-181)

Although it is possible to program a WebLogic Web Service manually by coding the standard JSR-921 EJB or Java class from scratch and generating its associated artifacts by hand (deployment descriptor files, WSDL, data binding artifacts for user-defined data types, and so on), the entire process can be difficult and tedious. For this reason, BEA recommends that you take advantage of the new JDK 1.5 metadata annotations feature and use a programming model in which you create an annotated Java file and then use Ant tasks to convert the file into the Java source code of a standard JSR-921 Java class or EJB and automatically generate all the associated artifacts.

The Java Web Service (JWS) annotated file (called a *JWS file* for simplicity) 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 JDK 1.5 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) as well as a set of WebLogic-specific ones.

Enterprise Web Services 1.1

The *Implementing Enterprise Web Services* 1.1 specification (JSR-921) defines the programming model and runtime architecture for implementing Web Services in Java that run on a J2EE application server, such as WebLogic Server. In particular, it specifies that programmers implement J2EE Web Services using one of two components:

- A Java class running in the Web container, or
- Astateless session EJB running in the EJB container

The specification also describes a standard J2EE Web Service packaging format, deployment model, and runtime services, all of which are implemented by WebLogic Web Services.

Note: JSR-921 is the 1.1 maintenance release of JSR-109, which was the J2EE 1.3 specification for Web Services.

SOAP 1.1

SOAP (Simple Object Access Protocol) is a lightweight XML-based protocol used to exchange information in a decentralized, distributed environment. WebLogic Server includes its own implementation of the SOAP 1.1 specification. The protocol consists of:

- An envelope that describes the SOAP message. The envelope contains the body of the message, identifies who should process it, and describes how to process it.
- A set of encoding rules for expressing instances of application-specific data types.
- A convention for representing remote procedure calls and responses.

This information is embedded in a Multipurpose Internet Mail Extensions (MIME)-encoded package that can be transmitted over HTTP or other Web protocols. MIME is a specification for formatting non-ASCII messages so that they can be sent over the Internet.

The following example shows a SOAP request for stock trading information embedded inside an HTTP request:

```
POST /StockQuote HTTP/1.1
Host: www.sample.com:7001
Content-Type: text/xml; charset="utf-8"
```

```
Content-Length: nnnn
SOAPAction: "Some-URI"

<SOAP-ENV:Envelope
   xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
         SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
     <SOAP-ENV:Body>
          <m:GetLastStockQuote xmlns:m="Some-URI">
               <symbol>BEAS</symbol>
          </m:GetLastStockQuote>
     </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

For more information, see SOAP 1.1 at http://www.w3.org/TR/SOAP.

SAAJ 1.2

The SOAP with Attachments API for Java (SAAJ) specification describes how developers can produce and consume messages conforming to the SOAP 1.1 specification and SOAP with Attachments notes.

The single package in the API, javax.xml.soap, provides the primary abstraction for SOAP messages with MIME attachments. Attachments may be entire XML documents, XML fragments, images, text documents, or any other content with a valid MIME type. In addition, the package provides a simple client-side view of a request-response style of interaction with a Web Service.

For more information, see and SOAP With Attachments API for Java (SAAJ) 1.1 at http://java.sun.com/xml/saaj/index.html.

WSDL 1.1

Web Services Description Language (WSDL) is an XML-based specification that describes a Web Service. A WSDL document describes Web Service operations, input and output parameters, and how a client application connects to the Web Service.

Developers of WebLogic Web Services do not need to create the WSDL files; you generate these files automatically as part of the WebLogic Web Services development process.

The following example, for informational purposes only, shows a WSDL file that describes the stock trading Web Service StockQuoteService that contains the method GetLastStockQuote:

```
<?xml version="1.0"?>
  <definitions name="StockQuote"
               targetNamespace="http://sample.com/stockquote.wsdl"
```

```
                xmlns:tns="http://sample.com/stockquote.wsdl"
                xmlns:xsd="http://www.w3.org/2000/10/XMLSchema"
                xmlns:xsd1="http://sample.com/stockquote.xsd"
                xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
                xmlns="http://schemas.xmlsoap.org/wsdl/">
       <message name="GetStockPriceInput">
           <part name="symbol" element="xsd:string"/>
       </message>
       <message name="GetStockPriceOutput">
           <part name="result" type="xsd:float"/>
       </message>
       <portType name="StockQuotePortType">
           <operation name="GetLastStockQuote">
              <input message="tns:GetStockPriceInput"/>
              <output message="tns:GetStockPriceOutput"/>
           </operation>
       </portType>
       <binding name="StockQuoteSoapBinding" type="tns:StockQuotePortType">
           <soap:binding style="rpc"
                         transport="http://schemas.xmlsoap.org/soap/http"/>
           <operation name="GetLastStockQuote">
              <soap:operation soapAction="http://sample.com/GetLastStockQuote"/>
              <input>
               <soap:body use="encoded" namespace="http://sample.com/stockquote"

encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
              </input>
              <output>
              <soap:body use="encoded" namespace="http://sample.com/stockquote"

encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
              </output>
           </operation>>
       </binding>
       <service name="StockQuoteService">
           <documentation>My first service</documentation>
           <port name="StockQuotePort" binding="tns:StockQuoteSoapBinding">
              <soap:address location="http://sample.com/stockquote"/>
           </port>
       </service>
  </definitions>
```

The WSDL specification includes optional extension elements that specify different types of bindings that can be used when invoking the Web Service. The WebLogic Web Services runtime:

- Fully supports SOAP bindings, which means that if a WSDL file includes a SOAP binding, the WebLogic Web Services will use SOAP as the format and protocol of the messages used to invoke the Web Service.

- Ignores HTTP GET and POST bindings, which means that if a WSDL file includes this extension, the WebLogic Web Services runtime skips over the element when parsing the WSDL.
- Partially supports MIME bindings, which means that if a WSDL file includes this extension, the WebLogic Web Services runtime parses the element, but does not actually create MIME bindings when constructing a message due to a Web Service invoke.

For more information, see Web Services Description Language (WSDL) 1.1 at http://www.w3.org/TR/wsdl.

JAX-RPC 1.1

The Java API for XML-based RPC (JAX-RPC) 1.1 is a Sun Microsystems specification that defines the Java APIs for making XML-based remote procedure calls (RPC). In particular, these APIs are used to invoke and get a response from a Web Service using SOAP 1.1, and XML-based protocol for exchange of information in a decentralized and distributed environment.

WebLogic Server implements all required features of the JAX-RPC Version 1.1 specification. Additionally, WebLogic Server implements optional data type support, as specified in:

- "Supported Built-In Data Types" on page 8-2
- "Supported User-Defined Data Types" on page 8-6

WebLogic Server does not implement optional features of the JAX-RPC specification, other than what is described in these sections.

The following table briefly describes the core JAX-RPC interfaces and classes.

Table 2-2 JAX-RPC Interfaces and Classes

javax.xml.rpc Interface or Class	Description
Service	Main client interface. Used for both static and dynamic invocations.
ServiceFactory	Factory class for creating `Service` instances.
Stub	Represents the client proxy for invoking the operations of a Web Service. Typically used for static invocation of a Web Service.

Table 2-2 JAX-RPC Interfaces and Classes

javax.xml.rpc Interface or Class	Description
Call	Used to invoke a Web Service dynamically.
JAXRPCException	Exception thrown if an error occurs while invoking a Web Service.

For detailed information on JAX-RPC, see http://java.sun.com/xml/jaxrpc/index.html.

For a tutorial that describes how to use JAX-RPC to invoke Web Services, see http://java.sun.com/webservices/docs/ea1/tutorial/doc/JAXRPC.html.

Web Services Security (WS-Security) 1.0

The following description of Web Services Security is taken directly from the OASIS standard 1.0 specification, titled *Web Services Security: SOAP Message Security*, dated March 2004:

> This specification proposes a standard set of SOAP extensions that can be used when building secure Web services to implement integrity and confidentiality. We refer to this set of extensions as the *Web Services Security Language* or *WS-Security*.
>
> WS-Security is flexible and is designed to be used as the basis for the construction of a wide variety of security models including PKI, Kerberos, and SSL. Specifically WS-Security provides support for multiple security tokens, multiple trust domains, multiple signature formats, and multiple encryption technologies.
>
> This specification provides three main mechanisms: security token propagation, message integrity, and message confidentiality. These mechanisms by themselves do not provide a complete security solution. Instead, WS-Security is a building block that can be used in conjunction with other Web service extensions and higher-level application-specific protocols to accommodate a wide variety of security models and encryption technologies.
>
> These mechanisms can be used independently (for example, to pass a security token) or in a tightly integrated manner (for example, signing and encrypting a message and providing a security token hierarchy associated with the keys used for signing and encryption).

WebLogic Web Services also implement the following token profiles:

- Web Services Security: Username Token Profile
- Web Services Security: X.509 Certificate Token Profile

- Web Services Security: SAML Token Profile

For more information, see the OASIS Web Service Security Web page at http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss.

UDDI 2.0

The Universal Description, Discovery and Integration (UDDI) specification defines a standard for describing a Web Service; registering a Web Service in a well-known registry; and discovering other registered Web Services.

For more information, see http://www.uddi.org.

JAX-R 1.0

The Java API for XML Registries (JAXR) provides a uniform and standard Java API for accessing different kinds of XML Registries. An XML registry is an enabling infrastructure for building, deploying, and discovering Web services.

Currently there are a variety of specifications for XML registries including, most notably, the ebXML Registry and Repository standard, which is being developed by OASIS and U.N./CEFACT, and the UDDI specification, which is being developed by a vendor consortium.

JAXR enables Java software programmers to use a single, easy-to-use abstraction API to access a variety of XML registries. Simplicity and ease of use are facilitated within JAXR by a unified JAXR information model, which describes content and metadata within XML registries.

For more information, see Java API for XML Registries at http://java.sun.com/xml/jaxr/index.jsp.

WS-Addressing 1.0

The WS-Addressing specification provides transport-neutral mechanisms to address Web services and messages. In particular, the specification defines a number of XML elements used to identify Web service endpoints and to secure end-to-end endpoint identification in messages.

All the asynchronous features of WebLogic Web Services (callbacks, conversations, and Web Service reliable messaging) use addressing in their implementation, but Web Service programmers can also use the APIs that conform to this specification stand-alone if additional addressing functionality is needed.

See Web Services Addressing (WS-Addressing).

WS-Policy 1.0

The Web Services Policy Framework (WS-Policy) specification provides a general purpose model and corresponding syntax to describe and communicate the policies of a Web Service. WS-Policy defines a base set of constructs that can be used and extended by other Web Services specifications to describe a broad range of service requirements, preferences, and capabilities.

See Web Services Policy Framework (WS-Policy).

WS-PolicyAttachment 1.0

The Web Services Policy Framework (WS-Policy) specification defines an abstract model and an XML-based expression grammar for policies. This specification, Web Services Policy Attachment (WS-PolicyAttachment), defines two general-purpose mechanisms for associating such policies with the subjects to which they apply. This specification also defines how these general-purpose mechanisms can be used to associate WS-Policy with WSDL and UDDI descriptions.

See Web Services Policy Attachment (WS-PolicyAttachment).

WS-ReliableMessaging 1.0

The WS-ReliableMessaging specification (February 4, 2005) describes how two Web Services running on different WebLogic Server instances can communicate reliably in the presence of failures in software components, systems, or networks. In particular, the specification provides for an interoperable protocol in which a message sent from a source endpoint to a destination endpoint is guaranteed either to be delivered or to raise an error.

See Web Services Reliable Messaging Protocol (WS-ReliableMessaging).

Additional Specifications Supported by WebLogic Web Services

- XML Schema Part 1: Structures at http://www.w3.org/TR/xmlschema-1/
- XML Schema Part 2: Data Types at http://www.w3.org/TR/xmlschema-2/

Common Web Services Use Cases and Examples

The following sections describe the most common Web Service use cases:

- "Creating a Simple HelloWorld Web Service" on page 3-2
- "Creating a Web Service With User-Defined Data Types" on page 3-7
- "Creating a Web Service from a WSDL File" on page 3-14
- "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23
- "Invoking a Web Service from a WebLogic Web Service" on page 3-28

These use cases provide step-by-step procedures for creating simple WebLogic Web Services and invoking an operation from a deployed Web Service. Each use case includes basic Java code and Ant `build.xml` files that you can use either in your own development environment to recreate the example, or by following the instructions to create and run the example outside of an already setup development environment.

The use cases do not go into detail about the tools and technologies used in the examples. For detailed information about specific features, see the relevant topics in this guide, in particular:

- Chapter 4, "Iterative Development of WebLogic Web Services"
- Chapter 5, "Programming the JWS File"
- Chapter 6, "Advanced JWS Programming: Implementing Asynchronous Features"
- Chapter 9, "Invoking Web Services"
- Appendix A, "Ant Task Reference"

Creating a Simple HelloWorld Web Service

This section describes how to create a very simple Web Service that contains a single operation. The *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 are a new JDK 5.0 feature, and the set of annotations used to annotate Web Service files are called JWS annotations. WebLogic Web Services use standard JWS annotations, as defined by JSR-181, as well as WebLogic-specific ones for added value.

The following example shows how to create a Web Service called `HelloWorldService` that includes a single operation, `sayHelloWorld`. For simplicity, the operation does nothing other than return the inputted String value.

1. Open a command window and set your WebLogic Server environment by executing 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 *`BEA_HOME`*`/user_projects/domains/`*`domainName`*, where *`BEA_HOME`* is the top-level installation directory of the BEA products and *`domainName`* is the name of your domain.

2. Create a project directory:

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

3. Create a `src` directory under the project directory, as well as sub-directories 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 by opening your favorite Java IDE or text editor and creating a Java file called `HelloWorldImpl.java` using the Java code specified in "Sample HelloWorldImpl.java JWS File" on page 3-4.

   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 and add a `taskdef` Ant task to specify the fully Java classname of the `jwsc` task:

```
<project name="webservices-hello_world" default="all">

  <taskdef name="jwsc"
           classname="weblogic.wsee.tools.anttasks.JwscTask" />

</project>
```

See "Sample Ant Build File for HelloWorldImpl.java" on page 3-5 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` Ant 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" />

    </jwsc>

  </target>
```

The `jwsc` WebLogic Web Service Ant task generates the supporting artifacts (such as the deployment descriptors, serialization classes for any user-defined data types, the WSDL file, and so on) , 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.

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 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:

```
  <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/HelloWorldImpl?WSDL

    You construct this URL by specifying the values of the `contextPath` and `serviceUri` attributes of the `WLHttpTransport` JWS annotation; however, because the JWS file in this use case does not include the `WLHttpTransport` annotation, specify the default values for the two attributes: the name of the Java class in the JWS file. Use the hostname and port relevant to your WebLogic Server instance.

See "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23 for an example of creating a JAX-RPC Java client application that invokes a Web Service.

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.

Sample HelloWorldImpl.java JWS File

```
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
 *
```

```
 * @author Copyright (c) 2005 by BEA Systems.  All rights reserved.
 */
public class HelloWorldImpl {

  // By default, all public methods are exposed as Web Services operation

  public String sayHelloWorld(String message) {
    System.out.println("sayHelloWorld:" + message);
    return "Here is the message: '" + message + "'";
  }
}
```

Sample Ant Build File for HelloWorldImpl.java

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

```
<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" />

    </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}/HelloWorldImpl/HelloWorldImpl?WSD
L"
      destDir="${clientclass-dir}"
      packageName="examples.webservices.hello_world.client"/>
```

```
    <javac
      srcdir="${clientclass-dir}" destdir="${clientclass-dir}"
      includes="**/*.java"/>

    <javac
      srcdir="src" destdir="${clientclass-dir}"
      includes="examples/webservices/hello_world/client/**/*.java"/>

  </target>

  <target name="run">
    <java classname="examples.webservices.hello_world.client.Main"
          fork="true" failonerror="true" >
      <classpath refid="client.class.path"/>
      <arg
 line="http://${wls.hostname}:${wls.port}/HelloWorldImpl/HelloWorldImpl"
/>
    </java> </target>

</project>
```

Creating a Web Service With User-Defined Data Types

The preceding use case 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 JAX-RPC type mapping file, and so on.

The following procedure is very similar to the procedure in "Creating a Simple HelloWorld Web Service" on page 3-2. 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. Open a command window and set your WebLogic Server environment.

2. Create a project directory:

```
prompt> mkdir /myExamples/complex
```

3. Create a `src` directory under the project directory, as well as sub-directories 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 by opening your favorite Java IDE or text editor and creating a Java file called `BasicStruct.java`, in the project directory, using the Java code specified in "Sample BasicStruct JavaBean" on page 3-9.

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

6. Create the JWS file that implements the Web Service using the Java code specified in "Sample ComplexImpl.java JWS File" on page 3-10.

   The sample JWS file uses more JWS annotations than in the preceding example: `@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 `@WebResult` to configure the parameters and return values; `@SOAPBinding` to specify the type of Web Service; and `@WLHttpTransport` to specify the URI used to invoke the 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 5, "Programming the JWS File."

7. Save the `ComplexImpl.java` file in the `src/examples/webservices/complex` sub-directory 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 "Sample Ant Build File for ComplexImpl.java JWS File" on page 3-12 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" />
  </jwsc>

   </target>
```

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 Administration Console or the `wldeploy` Ant task.

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

`http://`*`host`*`:`*`port`*`/complex/ComplexService?WSDL`

See "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23 for an example of creating a JAX-RPC Java client application that invokes a Web Service.

Sample BasicStruct JavaBean

```
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;
  }
}
```

Sample ComplexImpl.java JWS File

```
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 WebLogic-specific JWS annotation interface

import weblogic.jws.WLHttpTransport;
```

```
// 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,
             use=SOAPBinding.Use.LITERAL,
             parameterStyle=SOAPBinding.ParameterStyle.WRAPPED)

// WebLogic-specific JWS annotation that specifies the context path and service
// URI used to build the URI of the Web Service is "complex/ComplexService"

@WLHttpTransport(contextPath="complex", serviceUri="ComplexService",
                 portName="ComplexServicePort")

/**
 * This JWS file forms the basis of a WebLogic Web Service.  The Web Services
 * has 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.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

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;
  }
}
```

Sample Ant Build File for ComplexImpl.java JWS File

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

```
<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" />
  <property name="wls.port" value="7001" />
  <property name="wls.server.name" value="myserver" />

  <property name="ear.deployed.name" value="complexServiceEAR" />
  <property name="example-output" value="output" />
  <property name="ear-dir" value="${example-output}/complexServiceEar" />
  <property name="clientclass-dir" value="${example-output}/clientclass" />
```

```
<path id="client.class.path">
  <pathelement path="${clientclass-dir}"/>
  <pathelement path="${java.class.path}"/>
</path>

<taskdef name="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}"
    keepGenerated="true"
    >
    <jws file="examples/webservices/complex/ComplexImpl.java" />
  </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" failonerror="false"
    name="${ear.deployed.name}"
```

```
      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}/complex/ComplexService?WSDL"
      destDir="${clientclass-dir}"
      packageName="examples.webservices.complex.client"/>

    <javac
      srcdir="${clientclass-dir}" destdir="${clientclass-dir}"
      includes="**/*.java"/>

    <javac
      srcdir="src" destdir="${clientclass-dir}"
      includes="examples/webservices/complex/client/**/*.java"/>
  </target>

  <target name="run" >
    <java fork="true"
          classname="examples.webservices.complex.client.Main"
          failonerror="true" >
      <classpath refid="client.class.path"/>
      <arg
line="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
 />
    </java>
  </target>

</project>
```

Creating a Web Service from a WSDL File

Another typical use case 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 over the wire. Based on this

WSDL file, you generate the artifacts that implement the Web Service so that it can be deployed to WebLogic Server. These artifacts include:

- The JWS interface file that represents the Java implementation of your Web Service.
- Data binding artifacts used by WebLogic Server to convert between the XML and Java representations of the Web Service parameters and return values.
- A JWS file that contains a partial implementation of the generated JWS interface.
- Optional Javadocs for the generated JWS interface.

You use the `wsdlc` Ant task to generate these artifacts. Typically you run this Ant task one time to generate a JAR file that contains the generated JWS interface 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.

Warning: 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 interface and data binding artifacts.

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 interface 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 "Sample WSDL File" on page 3-19. The Web Service has one operation, `getTemp`, that returns a temperature when passed a zip code.

1. Open a command window and set your WebLogic Server environment by executing 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 *`BEA_HOME`*`/user_projects/domains/`*`domainName`*, where *`BEA_HOME`* is the top-level installation directory of the BEA products 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 "Sample WSDL File" on page 3-19 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 fully Java classname of the `wsdlc` task:

```
<project name="webservices-wsdlc" default="all">

  <taskdef name="wsdlc"
           classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>

</project>
```

   See "Sample Ant Build File for TemperatureService" on page 3-20 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:

```
  <target name="generate-from-wsdl">

    <wsdlc
        srcWsdl="wsdl_files/TemperatureService.wsdl"
        destJwsDir="output/compiledWsdl"
        destImplDir="output/impl"
        packageName="examples.webservices.wsdlc" />

  </target>
```

   The `wsdlc` task in the examples generates the JAR file that contains the JWS interface and data binding artifacts into the `output/compiledWsdl` directory under the current directory. It also generates a partial implementation file (`TemperaturePortTypeImpl.java`) of the JWS interface 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/TemperaturePortTypeImpl.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 "Sample TemperaturePortType Java Implementation File" on page 3-20 for an example; the added Java code is in bold. The generated JWS implementation file automatically includes values for the `@WebService` and `@WLHttpTransport` JWS annotations that correspond to the values in the original WSDL file.

   Warning: 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" on page A-28 for details.

   For simplicity, the sample `getTemp()` method in `TemperaturePortTypeImpl.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 `TemperaturePortTypeImpl.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/TemperaturePortTypeImpl.java
\
          src/examples/webservices/wsdlc/TemperaturePortTypeImpl.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"
  classname="weblogic.wsee.tools.anttasks.JwscTask" />

   <target name="build-service">

    <jwsc
       srcdir="src"
       destdir="${ear-dir}">
       <jws
           file="examples/webservices/wsdlc/TemperaturePortTypeImpl.java"
           compiledWsdl="output/compiledWsdl/TemperatureService_wsdl.jar"
       />
    </jwsc>
```

```
</target>
```

10. Execute the `build-service` target to generate a deployable Web Service:

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

    You can iteratively keep rerunning this target if you want to update the JWS file bit by bit.

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 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:

    ```
    <taskdef name="wldeploy"
             classname="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:

    `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.

See "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23 for an example of creating a JAX-RPC Java client application that invokes a Web Service.

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.

Sample WSDL File

```
<?xml version="1.0"?>

<definitions
   name="TemperatureService"
   targetNamespace="http://www.bea.com/wls90"
   xmlns:tns="http://www.bea.com/wls90"
   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
   xmlns="http://schemas.xmlsoap.org/wsdl/" >

        <message name="getTempRequest">
                <part name="zip" type="xsd:string"/>
        </message>

        <message name="getTempResponse">
                <part name="return" type="xsd:float"/>
        </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="rpc"
                             transport="http://schemas.xmlsoap.org/soap/http"/>
                <operation name="getTemp">
                        <soap:operation soapAction=""/>
                        <input>
                                <soap:body use="literal"
                                 namespace="http://www.bea.com/wls90" />
                        </input>
                        <output>
                                <soap:body use="literal"
                                 namespace="http://www.bea.com/wls90" />
                        </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>
```

Sample TemperaturePortType Java Implementation File

```
package examples.webservices.wsdlc;

import javax.jws.WebService;
import weblogic.jws.*;

/**
 * TemperaturePortTypeImpl class implements web service endpoint interface
TemperaturePortType */

@WebService(
  serviceName="TemperatureService",
  endpointInterface="examples.webservices.wsdlc.TemperaturePortType")

@WLHttpTransport(
  contextPath="temp",
  serviceUri="TemperatureService",
  portName="TemperaturePort")
public class TemperaturePortTypeImpl implements TemperaturePortType {

  public TemperaturePortTypeImpl() {

  }

  public float getTemp(java.lang.String zip)

  {
     return 1.234f;
  }
}
```

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" />

      </target>

      <target name="build-service">

        <jwsc
          srcdir="src"
          destdir="${ear-dir}">

          <jws file="examples/webservices/wsdlc/TemperaturePortTypeImpl.java"
             compiledWsdl="${compiledWsdl-dir}/TemperatureService_wsdl.jar" />

        </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"/>
```

```
    <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" >
      <classpath refid="client.class.path"/>
      <arg

line="http://${wls.hostname}:${wls.port}/temp/TemperatureService?WSDL" />
    </java>

  </target>

</project>
```

Invoking a Web Service from a Stand-alone JAX-RPC Java Client

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:

- Java source code for the JAX-RPC `Stub` and `Service` interface implementations for the particular Web Service you want to invoke.
- Java classes for any user-defined XML Schema data types included in the WSDL file.
- JAX-RPC mapping deployment descriptor file which contains information about the mapping between the Java data types and their corresponding XML Schema types in the WSDL file.
- Client-side copy of 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 "Creating a Web Service With User-Defined Data Types" on page 3-7. The `echoComplexType` operation takes as both a parameter and return type the `BasicStruct` user-defined data type. It is assumed in this procedure that you have already created and deployed the `ComplexService` Web Service.

1. Open a command window and set your WebLogic Server environment by executing 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 `BEA_HOME/user_projects/domains/domainName`, where `BEA_HOME` is the top-level installation directory of the BEA products 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 sub-directories 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 fully Java classname of the `clientgen` task:

```
<project name="webservices-simple_client" default="all">

  <taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

</project>
```

   See "Sample Ant Build File For Building Stand-alone Client Application" on page 3-27 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:

```
<target name="build-client">

  <clientgen
   wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    destDir="output/clientclass"
    packageName="examples.webservices.simple_client"/>
```

```
 <javac
   srcdir="output/clientclass" destdir="output/clientclass"
   includes="**/*.java"/>

 <javac
    srcdir="src" destdir="output/clientclass"
    includes="examples/webservices/simple_client/*.java"/>

</target>
```

The `clientgen` Ant task uses the WSDL of the deployed `ComplexService` Web Service to generate the needed 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.

The `clientgen` Ant task also automatically generates the `examples.webservices.complex.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 stand-alone Java program described in the next step, into class files.

6. Create the Java client application file that invokes the `echoComplexType` operation by opening your favorite Java IDE or text editor, creating a Java file called `Main.java` using the code specified in "Sample Java Client Application" on page 3-26.

   The `Main` client application takes a single argument: the WSDL URL of the Web Service. The application then follows standard JAX-RPC guidelines to invoke an operation of the Web Service using the Web Service-specific implementation of the `Service` interface generated by `clientgen`. The application also imports and uses the `BasicStruct` user-defined type, generated by the `clientgen` Ant task, that is used as a parameter and return value for the `echoStruct` operation. For details, see Chapter 9, "Invoking Web Services."

7. Save the `Main.java` file in the `src/examples/webservices/simple_client` sub-directory of the main project directory.

8. Execute the `clientgen` and `javac` Ant tasks by specifying the `build-client` target at the command line:

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

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

9. Add the following targets to the `build.xml` file, used to execute the `Main` application:

```
<path id="client.class.path">
  <pathelement path="output/clientclass"/>
  <pathelement path="${java.class.path}"/>
</path>

<target name="run" >

  <java fork="true"
        classname="examples.webservices.simple_client.Main"
        failonerror="true" >
    <classpath refid="client.class.path"/>
    <arg
line="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    />
  </java>

</target>
```

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.

Sample Java Client Application

```
package examples.webservices.simple_client;

import java.rmi.RemoteException;

import javax.xml.rpc.ServiceException;

// import the BasicStruct class, used as a param and return value of the
// echoComplexType operation.  The class is generated automatically by
// the clientgen Ant task.

import examples.webservices.complex.BasicStruct;

/**
 * This is a simple stand-alone client application that invokes the
 * the echoComplexType operation of the ComplexService Web service.
```

```
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public class Main {

  public static void main(String[] args)
      throws ServiceException, RemoteException{

    ComplexService service = new ComplexService_Impl (args[0]);
    ComplexPortType port = service.getComplexServicePort();

    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());
  }
}
```

Sample Ant Build File For Building Stand-alone Client Application

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

```
<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"/>

    <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"/>
      <arg
line="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
 />
    </java>
  </target>

</project>
```

Invoking a Web Service from a WebLogic Web Service

You can also invoke a Web Service (WebLogic, .NET, and so on) from within a deployed WebLogic Web Service, rather than from a stand-alone client. The procedure is similar to that described in "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23. You run the `clientgen` Ant task to generate the client stubs and follow standard JAX-RPC guidelines in the client application; however, in this case, you use the JAX-RPC APIs in the JWS file that implements the Web Service that invokes the other Web Service rather than in the stand-alone Java client application.

The following example shows how to write a JWS file that invokes the `echoComplexType` operation of the `ComplexService` Web Service described in "Creating a Web Service With User-Defined Data Types" on page 3-7; it is assumed that you have successfully deployed the `ComplexService` Web Service.

1. Open a command window and set your WebLogic Server environment by executing 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 *`BEA_HOME`*`/user_projects/domains/`*`domainName`*, where *`BEA_HOME`* is the top-level installation directory of the BEA products 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 sub-directories 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 "Sample ClientServiceImpl.java JWS File" on page 3-32.

   The sample JWS file shows a Java class called `ClientServiceImpl` that contains a single public method, `callComplexService()`. The Java class imports the JAX-RPC stubs, generated later on by the `clientgen` Ant task, as well as the `BasicStruct` JavaBean (also generated by `clientgen`), which is 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 two parameters: a `BasicStruct` which is passed on to the `echoComplexType` operation of the `ComplexService` Web Service, and the URL of the `ComplexService` Web Service. The method then uses the standard JAX-RPC APIs to get the `Service` and `PortType` of the `ComplexService`, using the stubs generated by `clientgen`, 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 tasks:

```
<project name="webservices-service_to_service" default="all">

  <path id="ws.clientService.class.path">
    <pathelement path="output/tempjardir"/>
    <pathelement path="${java.class.path}"/>
  </path>

  <taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

  <taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

</project>
```

The `path` task sets up the `ws.clientService.class.path` variable which will later be used to add to the CLASSPATH. The `taskdef` tasks to define the full classname of the `jwsc` and `clientgen` Ant tasks.

See "Sample Ant Build File For Building ClientService" on page 3-33 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 `${clientService-ear-dir}`, rather than always using the hard-coded name for the EAR directory.

7. Add the following calls to the `clientgen.`, `jwsc`, `javac`, and `copy` Ant tasks to the `build.xml` file, wrapped inside of the `build-service` target:

```
<target name="build-service">

  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    destDir="output/tempjardir"
    packageName="examples.webservices.service_to_service"/>

  <javac
    source="1.5"
    srcdir="output/tempjardir"
    destdir="output/tempjardir"
    includes="**/*.java"/>

  <jwsc
      srcdir="src"
      destdir="output/ClientServiceEar"
      classpathref="ws.clientService.class.path">

      <jws
     file="examples/webservices/service_to_service/ClientServiceImpl.java" />
```

```
</jwsc>

<copy todir="output/ClientServiceEar/APP-INF/classes">
     <fileset dir="output/tempjardir" />
</copy>

      </target>
```

In the preceding example, you first run use `clientgen` and `javac` to generate and compile the JAX-RPC stubs for the deployed `ComplexService` Web Service; this is because the `ClientServiceImpl` JWS file, which invokes `ComplexService`, imports these generated classes, and the `jwsc` task will fail if these classes do not already exist. When you execute the `jwsc` Ant task, use the `classpathref` attribute to add to the CLASSPATH the temporary directory into which `clientgen` generated its artifacts.

You then use the `copy` Ant task to copy the `clientgen`-generated artifacts into the `APP-INF/classes` directory of the EAR so that the `ClientService` Web Service can find them.

Note: The `APP-INF/classes` directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

8. Execute the `clientgen`, `jwsc`, `javac`, and `copy` Ant tasks by specifying the `build-service` target at the command line:

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

   See the `output/ClientServiceEar` directory and temporary `output/tempjardir` directory, to view the files and artifacts generated by the `jwsc` and `clientgen` Ant tasks.

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 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:

    ```
    <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 "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23 for an example of creating a JAX-RPC Java client application that invokes a Web Service.

Sample ClientServiceImpl.java JWS File

```
package examples.webservices.service_to_service;

import java.rmi.RemoteException;
import javax.xml.rpc.ServiceException;

import javax.jws.WebService;
import javax.jws.WebMethod;

import weblogic.jws.WLHttpTransport;

// Import the BasicStruct data type, generated by clientgen and used
// by the ComplexService Web Service

import examples.webservices.complex.BasicStruct;

// Import the JAX-RPC Stubs for invoking the ComplexService Web Service.
// Stubs generated by clientgen

import examples.webservices.service_to_service.ComplexPortType;
import examples.webservices.service_to_service.ComplexService_Impl;
import examples.webservices.service_to_service.ComplexService;

@WebService(name="ClientPortType", serviceName="ClientService",
            targetNamespace="http://examples.org")

@WLHttpTransport(contextPath="ClientService", serviceUri="ClientService",
                 portName="ClientServicePort")

public class ClientServiceImpl {

  @WebMethod()
  public String callComplexService(BasicStruct input, String serviceUrl)
      throws ServiceException, RemoteException
  {
```

```
      // Create service and port stubs to invoke ComplexService
      ComplexService service = new ComplexService_Impl(serviceUrl + "?WSDL");
      ComplexPortType port = service.getComplexServicePort();

      // 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() + "'";

  }
}
```

Sample Ant Build File For Building ClientService

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

```
<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="clientService.ear.deployed.name" value="ClientServiceEar" />
  <property name="example-output" value="output" />
  <property name="tempjar-dir" value="${example-output}/tempjardir" />
  <property name="clientService-ear-dir"
           value="${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>

  <path id="ws.clientService.class.path">
    <pathelement path="${tempjar-dir}"/>
    <pathelement path="${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">

  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    destDir="${tempjar-dir}"
    packageName="examples.webservices.service_to_service"/>

  <javac
    source="1.5"
    srcdir="${tempjar-dir}"
    destdir="${tempjar-dir}"
    includes="**/*.java"/>

  <jwsc
      srcdir="src"
      destdir="${clientService-ear-dir}"
      classpathref="ws.clientService.class.path">

      <jws
       file="examples/webservices/service_to_service/ClientServiceImpl.java"
     />

  </jwsc>

  <copy todir="${clientService-ear-dir}/APP-INF/classes">
       <fileset dir="${tempjar-dir}" />
  </copy>

</target>

<target name="deploy">
  <wldeploy action="deploy" name="${clientService.ear.deployed.name}"
    source="${clientService-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="${clientService.ear.deployed.name}"
    failonerror="false"
    user="${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}/ClientService/ClientService?WSDL"
      destDir="${clientclass-dir}"
      packageName="examples.webservices.service_to_service.client"/>

    <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"/>
          <arg

line="http://${wls.hostname}:${wls.port}/ClientService/ClientService"
         />
    </java>

  </target>

</project>
```

Iterative Development of WebLogic Web Services

The following sections describe the iterative development process for WebLogic Web Services:

- "Overview of the WebLogic Web Service Programming Model" on page 4-2
- "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2
- "Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps" on page 4-4
- "Creating the Basic Ant build.xml File" on page 4-5
- "Running the jwsc WebLogic Web Services Ant Task" on page 4-6
- "Running the wsdlc WebLogic Web Services Ant Task" on page 4-9
- "Updating the Stubbed-Out JWS Implementation Class File Generated By wsdlc" on page 4-11
- "Deploying and Undeploying WebLogic Web Services" on page 4-13
- "Browsing to the WSDL of the Web Service" on page 4-15
- "Testing the Web Service" on page 4-16
- "Integrating Web Services Into the WebLogic Split Development Directory Environment" on page 4-16

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 new metadata feature of Version 5.0 of the JDK (specified by JSR-175), and include both the standard annotations defined by the *Web Services Metadata for the Java Platform* specification (JSR-181), as well as additional WebLogic-specific ones. For additional detailed information about this programming model, see "Anatomy of a WebLogic Web Service" on page 2-3.

The following sections describe the high-level steps for iteratively developing a Web Service, either starting from Java or starting from an existing WSDL file:

- "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2
- "Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps" on page 4-4

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.

Iterative Development of WebLogic Web Services Starting From Java: Main Steps

This section describes the general procedure for iteratively developing WebLogic Web Services starting from Java, if effect, coding the JWS file from scratch and later generating the WSDL file that describes the service. See Chapter 3, "Common Web Services Use Cases and Examples," for specific examples of this process. The following procedure is just a recommendation; if you have already set up your own development environment, you can use this procedure as a guide for updating your existing environment to develop WebLogic Web Services.

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 "Integrating Web Services Into the WebLogic Split Development Directory Environment" on page 4-16 for details.

To iteratively develop a WebLogic Web Service starting from Java, follow these steps:

1. Open a command window and set your WebLogic Server environment by executing 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 `BEA_HOME/user_projects/domains/domainName`, where `BEA_HOME` is the top-level installation directory of the BEA products and `domainName` is the name of your domain.
2. Create a project directory that will contain the JWS file, Java source for any user-defined data types, and the Ant `build.xml` file. You can name this directory anything you want.
3. In the project directory, create the JWS file that implements your Web Service.

   See Chapter 5, "Programming the JWS File."
4. If your Web Service uses user-defined data types, create the JavaBean that describes it.

   See "Programming the User-Defined Java Data Type" on page 5-19.
5. In the project directory, create a basic Ant build file called `build.xml`.

   See "Creating the Basic Ant build.xml File" on page 4-5.
6. Run the `jwsc` Ant task against the JWS file to generate 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 "Running the jwsc WebLogic Web Services Ant Task" on page 4-6.
7. Deploy the Web Service to WebLogic Server.

   See "Deploying and Undeploying WebLogic Web Services" on page 4-13.
8. Invoke the WSDL of the Web Service to ensure that it was deployed correctly.

   See "Browsing to the WSDL of the Web Service" on page 4-15.
9. Test the Web Service using the WebLogic Web Services test client.

   See "Testing the Web Service" on page 4-16.
10. To make changes to the Web Service, update the JWS file, undeploy the Web Service as described in "Deploying and Undeploying WebLogic Web Services" on page 4-13, then repeat the steps starting from running the `jwsc` Ant task.

See Chapter 9, "Invoking Web Services," for information on writing client applications that invoke a Web Service.

Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps

This section describes the general procedure for iteratively developing WebLogic Web Services based on an existing WSDL file. See Chapter 3, "Common Web Services Use Cases and Examples," for a specific example of this process. The procedure is just a recommendation; if you have already set up your own development environment, you can use this procedure as a guide for updating your existing environment to develop WebLogic Web Services.

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 "Integrating Web Services Into the WebLogic Split Development Directory Environment" on page 4-16 for details.

It is assumed in this procedure that you already have an existing WSDL file.

To iteratively develop a WebLogic Web Service starting from WSDL, follow these steps.

1. Open a command window and set your WebLogic Server environment by executing 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 *`BEA_HOME`*`/user_projects/domains/`*`domainName`*, where *`BEA_HOME`* is the top-level installation directory of the BEA products and *`domainName`* is the name of your domain.

2. Create a project directory that will contain the generated artifacts and the Ant `build.xml` file. You can name this directory anything you want.

3. In the project directory, create a basic Ant build file called `build.xml`.

   See "Creating the Basic Ant build.xml File" on page 4-5.

4. Put your WSDL file in a directory that the `build.xml` Ant build file is able to read. For example, you can put the WSDL file in a `wsdl_files` child directory of the project directory.

5. Run the `wsdlc` Ant task against the WSDL file to generate the JWS interface, the stubbed-out JWS class file, JavaBeans that represent the XML Schema data types, and so on, into output directories.

   See "Running the wsdlc WebLogic Web Services Ant Task" on page 4-9.

6. Update the stubbed-out JWS file generated by the `wsdlc` Ant task, adding the business code to make the Web Service work as you want.

See “Updating the Stubbed-Out JWS Implementation Class File Generated By wsdlc” on page 4-11.

7. Run the `jwsc` Ant task, specifying the artifacts generated by the `wsdlc` Ant task as well as your updated JWS implementation file, to generate an Enterprise Application that implements the Web Service.

   See “Running the jwsc WebLogic Web Services Ant Task” on page 4-6.

8. Deploy the Web Service to WebLogic Server.

   See “Deploying and Undeploying WebLogic Web Services” on page 4-13.

9. Invoke the deployed WSDL of the Web Service to test that the service was deployed correctly.

   The URL used to invoke the WSDL of the deployed Web Service is essentially the same as the value of the `location` attribute of the `<address>` element in the original WSDL (except for the host and port values which now correspond to the host and port of the WebLogic Server instance to which you deployed the service.) This is because the `wsdlc` Ant task generated values for the `contextPath` and `serviceURI` of the `@WLHttpTransport` annotation in the JWS implementation file so that together they create the same URI as the endpoint address specified in the original WSDL.

   See either the original WSDL or “Browsing to the WSDL of the Web Service” on page 4-15 for information about invoking the deployed WSDL.

10. Test the Web Service using the WebLogic Web Services test client.

    See “Testing the Web Service” on page 4-16.

11. To make changes to the Web Service, update the generated JWS file, undeploy the Web Service as described in “Deploying and Undeploying WebLogic Web Services” on page 4-13, then repeat the steps starting from running the `jwsc` Ant task.

See Chapter 9, “Invoking Web Services,” for information on writing client applications that invoke a Web Service.

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 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:

```
<project default="all">

  <target name="all"
          depends="clean,build-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>
```

Running the jwsc WebLogic Web Services Ant Task

The `jwsc` Ant task takes as input a JWS file that contains both standard (JSR-181) and WebLogic-specific 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:

- Java source files that implement a standard JSR-921 Web Service.
- All required deployment descriptors. In addition to the standard `webservices.xml` and JAX-RPC mapping files, the `jwsc` Ant task also generates the WebLogic-specific Web Services deployment descriptor (`weblogic-wesbservices.xml`), the `web.xml` and `weblogic.xml` files for Java class-implemented Web Services and the `ejb-jar.xml` and `weblogic-ejb-jar.xml` files for EJB-implemented Web Services.
- The XML Schema representation of any Java user-defined types used as parameters or return values to the Web Service operations.
- The WSDL file that publicly describes the Web Service.

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 `jwsc` Ant task to specify this `wsdlc`-generated JAR file.

After generating all the required artifacts, the `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.

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

```
<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" />
    </jwsc>

  </target>
```

where

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

  Note: You specify this attribute only in the "starting from WSDL" use case; this procedure is described in "Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps" on page 4-4.

The required `taskdef` element specifies the full class name of the `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" on page A-13 for more information.

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

```
<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" />

    </jwsc>

</target>
```

In the example, the Enterprise Application will be generated, in exploded form, in `output/helloWorldEar`, relative to the current directory. The JWS file is called `HelloWorldImpl.java`, and is located in the `src/examples/webservices/hello_world` directory, relative to the current directory. This implies that the JWS file is in the package `examples.webservices.helloWorld`.

The following example is similar to the preceding one, except that it uses the `compiledWsdl` attribute to specify the JAR file that contains `wsdlc`-generated artifacts (for the "starting with WSDL" use case):

```
    <taskdef name="jwsc"
             classname="weblogic.wsee.tools.anttasks.JwscTask" />

    <target name="build-service">

      <jwsc
        srcdir="src"
        destdir="output/wsdlcEar">

        <jws

           file="examples/webservices/wsdlc/TemperaturePortTypeImpl.java"

          compiledWsdl="output/compiledWsdl/TemperatureService_wsdl.jar"
/>

      </jwsc>
```

```
  </target>
```

In the preceding example, the `TemperaturePortTypeImpl.java` file is the stubbed-out JWS file that you previously updated to include the business logic to make your service work as you want. Because the `compiledWsdl` attribute is specified and points to a JAR file, the `jwsc` Ant task does not regenerate the artifacts that are included in the JAR.

To actually run this task, type at the command line the following :

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

See "jwsc" on page A-13 for additional attributes of the `jwsc` Ant task.

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:

- The JWS interface file that represents the Java implementation of your Web Service.
- Data binding artifacts used by WebLogic Server to convert between the XML and Java representations of the Web Service parameters and return values.
- A JWS file that contains a stubbed-out implementation of the generated JWS interface.
- Optional Javadocs for the generated JWS interface.

The `wsdlc` Ant task packages the JWS interface file 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:

```
<taskdef name="wsdlc"
        classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>

<target name="generate-from-wsdl">

  <wsdlc
      srcWsdl="WSDL_file"
      destJwsDir="JWS_interface_directory"
      destImplDir="JWS_implementation_directory"
      packageName="Package_name" />
</target>
```

where

- *WSDL_file* 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 interface 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 sub-directory hierarchy corresponding to its package name.

  The name of the generated JWS file is *PortType*Impl.java, where *PortType* refers to the name attribute of the <portType> element in the WSDL file for which you are generating a Web Service. For example, if the port type name is MyServicePortType, then the JWS implementation file is called MyServicePortTypeImpl.java.
- *Package_name* refers to the package into which the generated JWS interface 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.

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 also generate the stubbed-out JWS file to make your programming easier. BEA also 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:

```
<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" />

  </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. The JAR file that will contain the JWS interface and data binding artifacts is generated to the `output/compiledWsdl` directory; the name of the JAR file is `TemperatureService_wsdl.jar`. The package name of the generated JWS files is `examples.webservices.wsdld`. The stubbed-out JWS file is generated into the `impl_output/examples/webservices/wsdlc` directory relative to the current directory. Assuming that the port type name in the WSDL file is `TemperaturePortType`, then the name of the JWS implementation file is `TemperaturePortTypeImpl.java`.

To actually run this task, type the following at the command line:

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

See "wsdlc" on page A-28 for additional attributes of the `wsdlc` Ant task.

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 *`PortType`*`Impl.java`, where *`PortType`* is the name of the portType in the original WSDL. The class file includes everything you need to compile it into a Web Service, except for your own business logic in the methods that implement the operations.

The JWS class implements the JWS Web Service endpoint interface that corresponds to the WSDL file; the JWS interface 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` and `@WLHttpTransport` annotations in the JWS implementation class; the values of the attributes correspond to equivalent values 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; the `contextPath` and `serviceUri` attributes of `@WLHttpTransport` together make up the endpoint address specified by the `location` attribute of the `<address>` element in the WSDL.

When you update the JWS file, you add Java code to the methods so that the corresponding Web Service operations works as you want. Typically, the generated JWS file contains comments where you should add code, such as:

```
//replace with your impl here
```

You can also add additional JWS annotations to the file, with the following restrictions:

- The *only* standard JWS annotations (in the `javax.jws.*` package) you can include in the JWS implementation file are `@WebService`, `@HandlerChain`, `@SOAPMessageHandler`, and `@SOAPMessageHandlers`. If you specify any other standard JWS annotations, the `jwsc` Ant task returns error when you try to compile the JWS file into a Web Service.
- You can specify *only* the `serviceName` and `endpointInterface` attributes of the `@WebService` annotation. Use the `serviceName` attribute to specify 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 interface generated by the `wsdlc` Ant task.
- You can specify any WebLogic-specific JWS annotation that you want.

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

The following example shows the `wsdlc`-generated JWS implementation file from the WSDL shown in "Sample WSDL File" on page 3-19; the text in bold indicates where you would add Java code to implement the single operation (`getTemp`) of the Web Service:

```
package examples.webservices.wsdlc;

import javax.jws.WebService;
import weblogic.jws.*;

/**
 * TemperaturePortTypeImpl class implements web service endpoint interface
 * TemperaturePortType */

@WebService(
  serviceName="TemperatureService",
  endpointInterface="examples.webservices.wsdlc.TemperaturePortType")

@WLHttpTransport(
  contextPath="temp",
  serviceUri="TemperatureService",
  portName="TemperaturePort")

public class TemperaturePortTypeImpl implements TemperaturePortType {

  public TemperaturePortTypeImpl() {

  }

  public float getTemp(java.lang.String zipcode)

  {

    //replace with your impl here
```

```
        return 0;
    }
}
```

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 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 WebLogic Server Applications*.

This guide, because of its development nature, discusses just two ways of deploying Web Services:

- Using the wldeploy Ant Task to Deploy Web Services
- Using the Administration Console to Deploy Web Services

Using the wldeploy Ant Task to Deploy Web Services

The easiest way to quickly deploy a Web Service as part of the iterative development process is to add a target that executes the `wldeploy` WebLogic Ant task to your `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:

```
<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 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`.

```
<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:

```
<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.

Using the Administration Console to Deploy Web Services

To use the 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 Administration Console, see the Online Help.

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.
- *port* refers to the port number on which WebLogic Server is listening (default value is `7001`).
- *contextPath* refers to the value of the `contextPath` attribute of the `@WLHttpTransport` JWS annotation of the JWS file that implements your Web Service.
- *serviceUri* refers to the value of the `serviceUri` attribute of the `@WLHttpTransport` JWS annotation of the JWS file that implements your Web Service.

For example, assume you used the following `@WLHttpTransport` annotation in the JWS file that implements your Web Service

```
...
```

```
@WLHttpTransport(contextPath="complex",
                 serviceUri="ComplexService",
                 portName="ComplexServicePort")

/**
 * This JWS file forms the basis of a WebLogic Web Service.
 *
 */

public class ComplexServiceImpl {

...
```

The URL to view the WSDL of the Web Service, assuming the service is running on a host called `ariel` at the default port number (`7001`), is:

```
http://ariel:7001/complex/ComplexService?WSDL
```

Testing the Web Service

The WebLogic Web Services test client allows for convenient testing of WebLogic Web Services through a Web user interface without writing code. You can quickly and easily test any Web Service, including those with complex types and those using advanced features of WebLogic Server such as converations. The test client automatically maintains a full log of requests allowing you to return to previous call to to view the results. The test client is packaged as a J2EE application in an EAR archive.

To use the WebLogic Web Services test client to test your Web Services, you must first download a ZIP file from the BEA dev2dev Web site and install the EAR file on your WebLogic Server. After you have started the test client Enterprise application (called `wlstestclient` by default), you can invoke it by typing the following URL in your browser:

`http://`*`host`*`:`*`port`*`/wls_utc`

Enter the WSDL of the Web Service you want to test in the text field, then click Go. A list of the operations of the Web Service is displayed, along with text fields where you can enter relevant test data.

See the instructions on the dev2dev site for additional detailed information about downloading, installing, and using the test client.

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 already set up this type of environment for developing standard J2EE 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 for an Application and the `splitdir/helloWorldEar` example installed with WebLogic Server, located in the *BEA_HOME*`/weblogic90/samples/server/examples/src/examples` directory, where *BEA_HOME* refers to the main installation directory for BEA products, such as `c:/bea`.

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 "Running the jwsc WebLogic Web Services Ant Task" on page 4-6.

   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:

   ```
   <target name="build.helloWebService">

     <jwsc
         srcdir="helloWebService"
         destdir="destination_dir"
         keepGenerated="yes" >

         <jws file="examples/splitdir/hello/HelloWorldImpl.java" />
   ```

```
    </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:

```
<!-- Builds the entire helloWorldEar application -->

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

Warning: 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:

```
<target name="compile">

   <wlcompile srcdir="${src.dir}" destdir="${dest.dir}"
           excludes="appStartup,helloWebService">
   ...
   </wlcomplile>

...
</target>

<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>
```

Caution: Although the `jwsc` Ant task typically generates a Web Application WAR file from the JWS file that implements your Web Service, the task sometimes generates an EJB JAR file, depending on the JWS annotations specified in the JWS file. In that case you must add an `<ejb>` module element to the `application.xml` file instead. For more information about when the `jwsc` Ant task generates an EJB JAR file, see "jwsc" on page A-13.

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 "Browsing to the WSDL of the Web Service" on page 4-15.

Programming the JWS File

The following sections provide information about programming the JWS file that implements your Web Service:

- "Overview of JWS Files and JWS Annotations" on page 5-1
- "Programming the JWS File: Java Requirements" on page 5-2
- "Programming the JWS File: Typical Steps" on page 5-3
- "Accessing Runtime Information about a Web Service Using the JwsContext" on page 5-10
- "Should You Implement a Stateless Session EJB?" on page 5-16
- "Programming the User-Defined Java Data Type" on page 5-19
- "Throwing Exceptions" on page 5-22
- "Invoking Another Web Service from the JWS File" on page 5-24
- "JWS Programming Best Practices" on page 5-24

Overview of JWS Files and JWS Annotations

One way to program a WebLogic Web Service is to code the standard JSR-921 EJB or Java class from scratch and generate its associated artifacts manually (deployment descriptor files, WSDL file, data binding artifacts for user-defined data types, and so on). This process can be difficult and tedious. BEA recommends that you take advantage of the new JDK 5.0 metadata annotations feature and use a programming model in which you create an annotated Java file and then use Ant tasks to compile the file into the Java source code 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 JDK 5.0 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) as well as a set of WebLogic-specific ones.

This topic is part of the iterative development procedure for creating a Web Service, described in "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2 and "Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps" on page 4-4. It is assumed that you have created a JWS file and now want to add JWS annotations to it.

Programming the JWS File: Java Requirements

When you program your JWS file, you must follow a set of requirements, as specified by the JSR-181 specification (*Web Services Metadata for the Java Platform*). In particular, the Java class that implements the Web Service:

- Must be an outer public class, must not be 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` and `@WebService.serviceName`.
- 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 those public methods that are to be exposed. If a `@WebMethod` annotation is present, only the methods to which it is applied are exposed.

Programming the JWS File: Typical Steps

The following sections how to use standard (JSR-181) and WebLogic-specific annotations in your JWS file 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. The sections discuss the following basic JWS annotations:

- `@WebService` (standard)
- `@SOAPBinding` (standard)
- `@WLHttpTransport` (WebLogic-specific)
- `@WebMethod` (standard)
- `@Oneway` (standard)
- `@WebParam` (standard)
- `@WebResult` (standard)

See Chapter 6, "Advanced JWS Programming: Implementing Asynchronous Features," for information on using other JWS annotations to program more advanced features, such as Web Service reliable messaging, conversations, SOAP message handlers, and so on.

For reference documentation about both the standard and WebLogic-specific JWS annotations, see Appendix B, "JWS Annotation Reference."

The following procedure describes the typical basic steps when programming the JWS file that implements a Web Service. See "Example of a JWS File" on page 5-4 for a code example.

1. Import the standard JWS annotations that will be used in your JWS file. The standard JWS annotations are in either the `javax.jws` or `javax.jws.soap` package. For example:

   ```
   import javax.jws.WebMethod;
   import javax.jws.WebService;
   import javax.jws.soap.SOAPBinding;
   ```

2. Import the WebLogic-specific annotations used in your JWS file. The WebLogic-specific annotations are in the `weblogic.jws` package. For example:

   ```
   import weblogic.jws.WLHttpTransport;
   ```

3. Add the standard and required `@WebService` JWS annotation at the class level to specify that the Java class exposes a Web Service.

See "Specifying That the JWS File Implements a Web Service" on page 5-6.

4. Add the standard `@SOAPBinding` JWS annotation at the class level to specify the mapping between the Web Service and the SOAP message protocol. In particular, use this annotation to specify whether the Web Service is document-literal, RPC-encoded, and so on.

   Although this JWS annotation is not required, BEA 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.

   See "Specifying the Mapping of the Web Service to the SOAP Message Protocol" on page 5-6.

5. Add the WebLogic-specific `@WLHttpTransport` JWS annotation at the class level to specify the context path and service URI used in the URL that invokes the Web Service.

   Although this JWS annotation is not required, BEA recommends you explicitly specify it in your JWS file so that it is clear what URL a client application uses to invoke the Web Service.

   See "Specifying the Context Path and Service URI of the Web Service" on page 5-7.

6. For each method in the JWS file that you want to expose as a public operation, add a standard `@WebMethod` annotation. Optionally specify that the operation takes only input parameters but does not return any value by using the standard `@Oneway` annotation.

   See "Specifying That a JWS Method Be Exposed as a Public Operation" on page 5-7.

7. Optionally customize the name of the input parameters of the exposed operations by adding standard `@WebParam` annotations.

   See "Customizing the Mapping Between Operation Parameters and WSDL Parts" on page 5-8.

8. Optionally customize the name and behavior of the return value of the exposed operations by adding standard `@WebResult` annotations.

   See "Customizing the Mapping Between the Operation Return Value and a WSDL Part" on page 5-9.

Example of a JWS File

The following sample JWS file shows how to implement a simple Web Service.

```
package examples.webservices.simple;

// Import the standard JWS annotation interfaces
```

```
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;

// Import the WebLogic-specific JWS annotation interfaces

import weblogic.jws.WLHttpTransport;

// Standard JWS annotation that specifies that the porType name of the Web
// Service is "SimplePortType", the service name is "SimpleService", and the
// targetNamespace used in the generated WSDL is "http://example.org"

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

// Standard JWS annotation that specifies the mapping of the service onto the
// SOAP message protocol.  In particular, it specifies that the SOAP messages
// are document-literal-wrapped.

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

// WebLogic-specific JWS annotation that specifies the context path and
// service URI used to build the URI of the Web Service is
// "simple/SimpleService"

@WLHttpTransport(contextPath="simple", serviceUri="SimpleService",
                 portName="SimpleServicePort")

/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHello
 *
 */

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 + "'";
  }
}
```

Specifying That the JWS File Implements a Web Service

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 attribute of the `@WebService` annotation:

- `endpointInterface`—Fully qualified name of an existing service endpoint interface file. If you specify this attribute, the `jwsc` Ant task does not generate the interface for you, but assumes you have already created it and it is in your CLASSPATH.

None of the attributes of the `@WebService` annotation is required. See the *Web Services Metadata for the Java Platform* for the default values of each attribute.

Specifying the Mapping of the Web Service to the SOAP Message Protocol

It is assumed that you want your Web Service to be available over the SOAP 1.1 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 RPC-encoded or document-literal-wrapped), as shown in the following code excerpt:

```
@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.

You use the `parameterStyle` attribute (in conjunction with the `style=SOAPBinding.Style.DOCUMENT` 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` annotation.

Table 5-1 Attributes of the @SOAPBinding Annotation

Attribute	Possible Values	Default Value
style	`SOAPBinding.Style.RPC` `SOAPBinding.Style.DOCUMENT`	`SOAPBinding.Style.DOCUMENT`
use	`SOAPBinding.Use.LITERAL` `SOAPBinding.Use.ENCODED`	`SOAPBinding.Use.LITERAL`
parameterStyle	`SOAPBinding.ParameterStyle.BARE` `SOAPBinding.ParameterStyle.WRAPPED`	`SOAPBinding.ParameterStyle.WRAPPED`

Specifying the Context Path and Service URI of the Web Service

Use the WebLogic-specific `@WLHttpTransport` annotation to specify the context path and service URI sections of the URL used to invoke the Web Service over the HTTP transport, as well as the name of the port in the generated WSDL, as shown in the following code excerpt:

```
@WLHttpTransport(contextPath="simple", serviceUri="SimpleService",
                 portName="SimpleServicePort")
```

In the example, the name of the port in the WSDL (in particular, the `name` attribute of the `<port>` element) file generated by the `jwsc` Ant task is `SimpleServicePort`. The URL used to invoke the Web Service over HTTP includes a context path of `simple` and a service URI of `SimpleService`, as shown in the following example:

```
http://host:port/simple/SimpleService
```

For reference documentation on this and other WebLogic-specific annotations, see Appendix B, "JWS Annotation Reference."

Specifying That a JWS Method Be Exposed as a Public Operation

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:

```
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.

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:

```
  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* for the default values of each attribute, as well as additional information about the `@WebMethod` and `@Oneway` annotations.

Customizing the Mapping Between Operation Parameters and WSDL Parts

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:

```
  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`). The OUT and INOUT modes may be specified only for parameter types that conform to the JAX-RPC definition of `Holder` types. 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* for the default value of each attribute.

Customizing the Mapping Between the Operation Return Value and a WSDL Part

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:

```
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* for the default value of each attribute.

Accessing Runtime Information about a Web Service Using the JwsContext

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 can use to access, and sometimes change, runtime information about the service. Much of this information is related to conversations, such as whether the current conversation is finished, the current values of the conversational properties, changing conversational properties at runtime, and so on. (See "Creating Conversational Web Services" on page 6-25 for information about conversations and how to implement them.) Some of the information accessible via the context is more generic, such as the protocol that was used to invoke the Web Service (HTTP/S or JMS), the SOAP headers that were in the SOAP message request, and so on.

You can use annotations and WebLogic Web Service APIs in your JWS file to access runtime context information, as described in the following sections.

Guidelines for Accessing the Web Service Context

The following example shows a simple JWS file that uses the context to determine the protocol that was used to invoke the Web Service; the code in bold is discussed in the programming guidelines described after the example.

```
package examples.webservices.jws_context;

import javax.jws.WebMethod;
import javax.jws.WebService;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.Context;

import weblogic.wsee.jws.JwsContext;
import weblogic.wsee.jws.Protocol;

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

@WLHttpTransport(contextPath="contexts", serviceUri="JwsContext",
                 portName="JwsContextPort")

/**
 * Simple web service to show how to use the @Context annotation.
 */

public class JwsContextImpl {

  @Context
  private JwsContext ctx;

  @WebMethod()
  public String getProtocol() {

    Protocol protocol = ctx.getProtocol();

    System.out.println("protocol: " + protocol);
    return "This is the protocol: " + protocol;
  }
}
```

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 `@weblogic.jws.Context` JWS annotation:

  ```
  import weblogic.jws.Context;
  ```

- Import the `weblogic.wsee.jws.JwsContext` API, as well as any other related APIs that you might use (the example also uses the `weblogic.wsee.jws.Protocol` API):

  ```
  import weblogic.wsee.jws.JwsContext;
  import weblogic.wsee.jws.Protocol;
  ```

  See the `weblogic.wsee.*` Javadocs for reference documentation about the context-related APIs.

- Annotate a private variable, of data type `weblogic.wsee.jws.JwsContext`, with the field-level `@Context` JWS annotation:

```
@Context
private JwsContext ctx;
```

  WebLogic Server automatically assigns the annotated variable (in this case, `ctx`) with a runtime implementation of `JwsContext` the first time the Web Service is invoked, which is how you can later use the variable without explicitly initializing it in your code.

- Use the methods of the `JwsContext` class to get, and sometimes change, runtime information about the Web Service. The following example shows how to get the protocol that was used to invoke the Web Service:

```
Protocol protocol = ctx.getProtocol();
```

  See "Methods of the JwsContext" on page 5-12 for the full list of available methods.

Methods of the JwsContext

The following table briefly describes the methods of the `JwsContext` that you can use in your JWS file to access runtime information about the Web Service. See `weblogic.wsee.*` Javadocs for detailed reference information about `JwsContext`, and other context-related APIs, as `Protocol` and `ServiceHandle`.

Table 5-2 Methods of the JwsContext

Method	Returns	Description
isFinished()	boolean	Returns a boolean value specifying whether the current conversation is finished, or if it is still continuing. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
finishConversation()	void	Finishes the current conversation. This method is equivalent to a client application invoking a method that has been annotated with the `@Conversation (Conversation.Phase.FINISH)` JWS annotation. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.

Table 5-2 Methods of the JwsContext

Method	Returns	Description
setMaxAge(java.util.Date)	void	Sets a new maximum age for the conversation to an absolute `Date`. If the date parameter is in the past, WebLogic Server immediately finishes the conversation. This method is equivalent to the `maxAge` attribute of the `@Conversational` annotation, which specifies the *default* maximum age of a conversation. Use this method to override this default value at runtime. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
setMaxAge(String)	void	Sets a new maximum age for the conversation by specifying a `String` duration, such as `1 day`. Valid values for the `String` parameter are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a maximum age of ten minutes, use the following syntax: `ctx.setMaxAge("10 minutes")` This method is equivalent to the `maxAge` attribute of the `@Conversational` annotation, which specifies the *default* maximum age of a conversation. Use this method to override this default value at runtime. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
getMaxAge()	long	Returns the maximum allowed age, in seconds, of a conversation. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.

Table 5-2 Methods of the JwsContext

Method	Returns	Description
getCurrentAge()	long	Returns the current age, in seconds, of the conversation. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
resetIdleTime()	void	Resets the timer which measures the number of seconds since the last activity for the current conversation. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
setMaxIdleTime(long)	void	Sets the number of seconds that the conversation can remain idle before WebLogic Server finishes it due to client inactivity. This method is equivalent to the `maxIdleTime` attribute of the `@Conversational` annotation, which specifies the *default* idle time of a conversation. Use this method to override this default value at runtime. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.

Table 5-2 Methods of the JwsContext

Method	Returns	Description
setMaxIdleTime(String)	void	Sets the number of seconds, specified as a `String`, that the conversation can remain idle before WebLogic Server finishes it due to client inactivity. Valid values for the `String` parameter are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a maximum idle time of ten minutes, use the following syntax: `ctx.setMaxIdleTime("10 minutes")` This method is equivalent to the `maxIdleTime` attribute of the `@Conversational` annotation, which specifies the *default* idle time of a conversation. Use this method to override this default value at runtime. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
getMaxIdleTime()	long	Returns the number of seconds that the conversation is allowed to remain idle before WebLogic Server finishes it due to client inactivity. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
getCurrentIdleTime()	long	Gets the number of seconds since the last client request, or since the conversation's maximum idle time was reset. Use this method only in conversational Web Services, or those that have been annotated with the `@Conversation` or `@Conversational` annotation.
getCallerPrincipal()	java.security.Principal	Returns the security principal associated with the operation that was just invoked, assuming that basic authentication was performed.

Table 5-2 Methods of the JwsContext

Method	Returns	Description
isCallerInRole(String)	boolean	Returns `true` if the authenticated principal is within the specified security role.
getService()	weblogic.wsee.jws.ServiceHandle	Returns an instance of `ServiceHandle`, a WebLogic Web Service API, which you can query to gather additional information about the Web Service, such as the conversation ID (if the Web Service is conversational), the URL of the Web Service, and so on.
getLogger(String)	weblogic.wsee.jws.util.Logger	Gets an instance of the `Logger` class, which you can use to send messages from the Web Service to a log file.
getInputHeaders()	org.w3c.dom.Element[]	Returns an array of the SOAP headers associated with the SOAP request message of the current operation invoke.
setUnderstoodInputHeaders(boolean)	void	Indicates whether input headers should be understood.
getUnderstoodInputHeaders()	boolean	Returns the value that was most recently set by a call to setUnderstoodInputHeader.
setOutputHeaders(Element[])	void	Specifies an array of SOAP headers that should be associated with the outgoing SOAP response message sent back to the client application that initially invoked the current operation.
getProtocol()	weblogic.wsee.jws.Protocol	Returns the protocol (such as HTTP/S or JMS) used to invoke the current operation.

Should You Implement a Stateless Session EJB?

Typically, when you program the JWS file, you do not need to know what the underlying implementation of the Web Service is; instead, you let the `jwsc` Ant task that later compiles the JWS file determine the best implementation. The `jwsc` Ant task either implements the Web Service as a standard Java class packaged in a Web application, or adds a stateless session EJB "wrapper" in front of the Java class if the JWS file implements certain features, such as conversations or reliable messaging. In the latter case, the business logic of the Web Service is still in the Java class, but the EJB wrapper takes care of the additional framework needed to implement certain features. The `jwsc` Ant task packages these Web Services in an EJB JAR file.

In some cases, however, you must explicitly implement a stateless session EJB in your JWS file; this is because the Web Service itself must be implemented with an EJB, rather than just have an

EJB wrapper in front of the Java class. You must explicitly implement an EJB when you use the following JWS annotations in your JWS file:

- `@weblogic.jws.Transactional`
- `@weblogic.jws.security.SecurityRoles`
- `@weblogic.jws.security.SecurityIdentity`

If you use any of the preceding annotations in a JWS file that does not explicitly implement an EJB, the `jwsc` Ant task will later fail with an error.

Programming Guidelines When Implementing an EJB in Your JWS File

The general guideline is to always use EJBGen annotations in your JWS file to automatically generate, rather than manually create, the EJB Remote and Home interface classes and deployment descriptor files needed when implementing an EJB. EJBGen annotations work in the same way as JWS annotations: they follow the JDK 5.0 metadata syntax and greatly simplify your programming tasks.

For more information on EJBGen, see the EJBGen Reference section in Programming WebLogic Enterprise JavaBeans.

Follow these guidelines when explicitly implementing a stateless session EJB in your JWS file. See "Example of a JWS File That Implements an EJB" on page 5-18 for an example; the relevant sections are shown in bold:

- Import the standard J2EE EJB classes:

  ```
  import javax.ejb.SessionBean;
  import javax.ejb.SessionContext;
  ```

- Import the EJBGen annotations, all of which are in the `weblogic.ejbgen` package. At a minimum you need to import the `@Session` annotation; if you want to use additional EJBGen annotations in your JWS file to specify the shape and behavior of the EJB, see the EJBGen reference guide for the name of the annotation you should import.

  ```
  import weblogic.ejbgen.Session;
  ```

- At a minimum, use the `@Session` annotation at the class level to specify the name of the EJB:

  ```
  @Session(ejbName="TransactionEJB")
  ```

`@Session` is the only required EJBGen annotation when used in a JWS file. You can, if you want, use other EJBGen annotations to specify additional features of the EJB.

- Ensure that the JWS class implements `SessionBean`:

```
public class TransactionImpl implements SessionBean {...
```

- You must also include the standard EJB methods `ejbCreate()`, `ejbActivate()` and so on, although you typically do not need to add code to these methods unless you want to change the default behavior of the EJB:

```
  public void ejbCreate() {}
  public void ejbActivate() {}
  public void ejbRemove() {}
  public void ejbPassivate() {}
  public void setSessionContext(SessionContext sc) {}
```

If you follow all these guidelines in your JWS file, the `jwsc` Ant task later compiles the Web Service into an EJB and packages it into an EJB JAR file inside of the Enterprise Application.

Example of a JWS File That Implements an EJB

The following example shows a simple JWS file that includes the @Transactional annotation. For this reason, the JWS file must also explicitly implement a stateless session EJB. The relevant code is shown in bold.

```
package examples.webservices.transactional;

import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

import javax.jws.WebMethod;
import javax.jws.WebService;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.Transactional;

import weblogic.ejbgen.Session;

@Session(ejbName="TransactionEJB")

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

@WLHttpTransport(contextPath="transactions", serviceUri="TransactionService",
                 portName="TransactionPort")

/**
 * This JWS file forms the basis of simple EJB-implemented WebLogic
```

```
 * Web Service with a single operation: sayHello.  The operation executes
 * as part of a transaction.
 *
 */

public class TransactionImpl implements SessionBean {

  @WebMethod()
  @Transactional(value=true)

  public String sayHello(String message) {
    System.out.println("sayHello:" + message);
    return "Here is the message: '" + message + "'";
  }

  // Standard EJB methods.  Typically there's no need to override the methods.

  public void ejbCreate() {}
  public void ejbActivate() {}
  public void ejbRemove() {}
  public void ejbPassivate() {}
  public void setSessionContext(SessionContext sc) {}
}
```

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, such as the corresponding XML Schema representation of the Java user-defined data type, the JAX-RPC type mapping file, and so on.

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.

These requirements are specified by JAX-RPC 1.1; for more detailed information and the complete list of requirements, see the JAX-RPC specification at http://java.sun.com/xml/jaxrpc/index.jsp.

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 "Supported User-Defined Data Types" on page 8-6. See "Supported Built-In Data Types" on page 8-2 for the full list of supported built-in data types.

The following example shows a simple Java user-defined data type called `BasicStruct`:

```
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 "Sample ComplexImpl.java JWS File" on page 3-10:

```
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 WebLogic-specific JWS annotation interface

import weblogic.jws.WLHttpTransport;

// Import the BasicStruct JavaBean

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;
  }
}
```

Throwing Exceptions

When you write the error-handling Java code in methods of the JWS file, you can either throw your own user-defined exceptions or throw a `javax.xml.rpc.soap.SOAPFaultException` exception. If you throw a `SOAPFaultException`, WebLogic Server maps it to a SOAP fault and sends it to the client application that invokes the operation.

If your JWS file throws any type of Java exception other than `SOAPFaultException`, WebLogic Server tries to map it to a SOAP fault as best it can. However, if you want to control what the client application receives and send it the best possible exception information, you should explicitly throw a `SOAPFaultException` exception or one that extends the exception. See the JAX-RPC 1.1 specification at http://java.sun.com/xml/jaxrpc/index.jsp for detailed information about creating and throwing your own user-defined exceptions.

The following excerpt describes the `SOAPFaultException` class:

```
public class SOAPFaultException extends java.lang.RuntimeException {
    public SOAPFaultException (QName faultcode,
                               String faultstring,
                               String faultactor,
                               javax.xml.soap.Detail detail ) {...}
    public Qname getFaultCode() {...}
    public String getFaultString() {...}
    public String getFaultActor() {...}
    public javax.xml.soap.Detail getDetail() {...}
}
```

Use the SOAP with Attachments API for Java 1.1 (SAAJ) `javax.xml.soap.SOAPFactory.createDetail()` method to create the `Detail` object, which is a container for `DetailEntry` objects that provide detailed application-specific information about the error. You can use your own implementation of the `SOAPFactory`, or use BEA's, which can be accessed by calling the static method `weblogic.wsee.util.createSOAPFactory()` which returns a `javax.xml.soap.SOAPFactory object`.

The following JWS file shows an example of creating and throwing a `SOAPFaultException` from within a method that implements an operation of your Web Service; the sections in bold highlight the exception code:

```
package examples.webservices.soap_exceptions;

import javax.xml.namespace.QName;
import javax.xml.soap.Detail;
import javax.xml.soap.SOAPException;
import javax.xml.soap.SOAPFactory;
import javax.xml.rpc.soap.SOAPFaultException;
```

```
// Import the @WebService annotation

import javax.jws.WebService;

// Import WLHttpTransport

import weblogic.jws.WLHttpTransport;

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

@WLHttpTransport(contextPath="exceptions",
                 serviceUri="SoapExceptionsService",
                 portName="SoapExceptionsServicePort")
/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHelloWorld
 *
 * @author Copyright (c) 2005 by BEA Systems.  All rights reserved.
 */

public class SoapExceptionsImpl {

  public SoapExceptionsImpl() {

  }

  public void tirarSOAPException() {

    Detail detail = null;

    try {

      SOAPFactory soapFactory = SOAPFactory.newInstance();
      detail = soapFactory.createDetail();

    } catch (SOAPException e) {
        // do something
    }

    QName faultCode = null;
    String faultString = "the fault string";
    String faultActor = "the fault actor";
    throw new SOAPFaultException(faultCode, faultString, faultActor, detail);
  }
}
```

Warning: If you create and throw your own exception (rather than use `SOAPFaultException`) and two or more of the properties of your exception class are of the same data type, then you *must* also create setter methods for these properties, even though the

JAX-RPC specification does not require it. This is because when a WebLogic Web Service receives the exception in a SOAP message and converts the XML into the Java exception class, there is no way of knowing which XML element maps to which class property without the corresponding setter methods.

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 "Invoking a Web Service from a Stand-alone JAX-RPC Java Client" on page 3-23, such as running the `clientgen` Ant task to generate the client stubs and using standard JAX-RPC APIs in the client application; however, in this case, you use these APIs in the JWS file that implements the Web Service that invokes the other Web Service rather than in the standalone Java client application.

See "Invoking a Web Service from Another Web Service" on page 9-11 for detailed instructions.

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.

- Use `SOAPFaultExceptions` in your JWS file if you want to control the exception information that is passed back to a client application when an error is encountered while invoking a the Web Service.

- Even though it is not required, BEA recommends you always specify the `portName` attribute of the WebLogic-specific `@WLHttpTransport` annotation in your JWS file. If you do not specify this attribute, the `jwsc` Ant task will generate a port name for you when generating the WSDL file, but this name might not be very user-friendly. A consequence of this is that the `getXXX()` method you use in your client applications to invoke the Web Service will not be very well-named. To ensure that your client applications use the most user-friendly methods possible when invoking the Web Service, specify a relevant name of the Web Service port by using the `portName` attribute.

Advanced JWS Programming: Implementing Asynchronous Features

The following sections provide information about implementing asynchronous features using JWS files. The first four sections describe how to implement these features separately. Typically, however, programmers use these features together; see "Using the Asynchronous Features Together" on page 6-44 for more information.

- "Using Web Service Reliable Messaging" on page 6-1
- "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17
- "Creating Conversational Web Services" on page 6-25
- "Creating Buffered Web Services" on page 6-37
- "Using the Asynchronous Features Together" on page 6-44
- "Using Reliable Messaging or Asynchronous Request Response With a Proxy Server" on page 6-49

Using Web Service Reliable Messaging

Web Service reliable messaging is a framework whereby an application running in one application server can reliably invoke a Web Service running on another appication server, assuming that both servers implement the WS-ReliableMessaging specification. *Reliable* is defined as the ability to guarantee message delivery between the two Web Services.

Note: Web Services reliable messaging works between *any* two application servers that implement the WS-ReliableMessaging specification. In this document, however, it is assumed that the two application servers are WebLogic Server instances.

WebLogic Web Services 9.0 conform to the WS-ReliableMessaging specification (February 2005), which describes how two Web Services running on different application servers can communicate reliably in the presence of failures in software components, systems, or networks. 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:

- **AtMostOnce**—Messages are delivered at most once, without duplication. It is possible that some messages may not be delivered at all.
- **AtLeastOnce**—Every message is delivered at least once. It is possible that some messages are delivered more than once.
- **ExactlyOnce**—Every message is delivered exactly once, without duplication.
- **InOrder**—Messages are delivered in the order that they were sent. This delivery assurance can be combined with one of the preceding three assurances.

See the WS-ReliableMessaging specification for detailed documentation about the architecture of Web Service reliable messaging. "Using Web Service Reliable Messaging: Main Steps" on page 6-4 describes how to create the reliable and client Web Services and how to configure the two WebLogic Server instances to which the Web Services are deployed.

Note: Web Services reliable messaging is not supported with the JMS transport feature.

Use of WS-Policy Files for Web Service Reliable Messaging Configuration

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 specification provides a general purpose model and syntax to describe and communicate the policies of a Web service.

These WS-Policy files are XML files that describe features such as the version of the supported WS-ReliableMessaging specification, the source endpoint's retransmission interval, the destination endpoint's acknowledgment interval, and so on.

You specify the names of the WS-Policy files that are attached to your Web Service using the `@Policy` JWS annotation in your JWS file. Use the `@Policies` annotation to group together multiple `@Policy` annotations. For reliable messaging, you specify these annotations only at the class level.

WebLogic Server includes two simple WS-Policy files that you can specify in your JWS file if you do not want to create your own WS-Policy files:

- `DefaultReliability.xml`—Specifies typical values for the reliable messaging policy assertions, such as inactivity timeout of 10 minutes, acknowledgement interval of 200 milliseconds, and base retransmisstion interval of 3 seconds. See "DefaultReliability.xml WS-Policy File" on page 6-3 for the actual WS-Policy file.
- `LongRunningReliability.xml`—Similar to the preceding default reliable messaging WS-Policy file, except that it specifies a much longer activity timeout interval (24 hours.) See "LongRunningReliability.xml WS-Policy File" on page 6-4 for the actual WS-Policy file.

You cannot change these pre-packaged files, so if their values do not suit your needs, you must create your own WS-Policy file.

See "Creating the Web Service Reliable Messaging WS-Policy File" on page 6-8 for details about creating your own WS-Policy file if you do not want to one included with WebLogic Server. See Appendix C, "Web Service Reliable Messaging Policy Assertion Reference," for reference information about the reliable messaging policy assertions.

DefaultReliability.xml WS-Policy File

```
<?xml version="1.0"?>

<wsp:Policy
   xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm"
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
   xmlns:beapolicy="http://www.bea.com/wsrm/policy"
  >
  <wsrm:RMAssertion >
    <wsrm:InactivityTimeout
        Milliseconds="600000" />
    <wsrm:AcknowledgementInterval
        Milliseconds="200" />
    <wsrm:BaseRetransmissionInterval
        Milliseconds="3000" />
    <wsrm:ExponentialBackoff />
    <beapolicy:Expires Expires="P1D"/>
  </wsrm:RMAssertion>
</wsp:Policy>
```

LongRunningReliability.xml WS-Policy File

```
<?xml version="1.0"?>

<wsp:Policy
   xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm"
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
   xmlns:beapolicy="http://www.bea.com/wsrm/policy"
  >
  <wsrm:RMAssertion >
    <wsrm:InactivityTimeout
        Milliseconds="86400000" />
    <wsrm:AcknowledgementInterval
        Milliseconds="200" />
    <wsrm:BaseRetransmissionInterval
        Milliseconds="3000" />
    <wsrm:ExponentialBackoff />
    <beapolicy:Expires Expires="P1M"/>
  </wsrm:RMAssertion>
</wsp:Policy>
```

Using Web Service Reliable Messaging: Main Steps

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 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 that includes client code to invoke the reliable Web Service reliably is deployed, as well as the *destination* WebLogic Server instance on which the reliable Web Service itself is deployed.

The following procedure describes how to create a reliable Web Service, as well as a client Web Service that in turn invokes an operation of the reliable Web Service reliably. The procedure shows how to create the JWS files that implement the two Web Services from scratch; if you want to update existing JWS files, use this procedure as a guide. The procedure also shows how to configure the source and destination WebLogic Server instances.

It is assumed that you have created a WebLogic Server instance where 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 generated reliable Web Service.

It is further assumed that you have a similar setup for another WebLogic Server instance that hosts the client Web Service that invokes the Web Service reliably. For more information, see:

- Chapter 3, "Common Web Services Use Cases and Examples"
- Chapter 4, "Iterative Development of WebLogic Web Services"
- Chapter 5, "Programming the JWS File"
- Chapter 9, "Invoking Web Services"

1. Configure the destination WebLogic Server instance for Web Service reliable messaging.

   This is the WebLogic Server instance to which the reliable Web Service is deployed.

   See "Configuring the Destination WebLogic Server Instance" on page 6-6.

2. Configure the source WebLogic Server instance for Web Service reliable messaging.

   This is the WebLogic Server instance to which the client Web Service that invokes the reliable Web Service is deployed.

   See "Configuring the Source WebLogic Server Instance" on page 6-7.

3. 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. This step is not required if you plan to use one of the two WS-Policy files that are included in WebLogic Server; see "Use of WS-Policy Files for Web Service Reliable Messaging Configuration" on page 6-2 for more information.

   See "Creating the Web Service Reliable Messaging WS-Policy File" on page 6-8 for details about creating your own WS-Policy file.

4. Create a new JWS file, or update an existing one, which implements the reliable Web Service that will run on the destination WebLogic Server.

   See "Programming Guidelines for the Reliable JWS File" on page 6-10.

5. 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.

   See "Running the jwsc WebLogic Web Services Ant Task" on page 4-6 for general information about using the `jwsc` task.

6. Compile your destination JWS file by calling the appropriate target and deploy to the destination WebLogic Server. For example:

   ```
   prompt> ant build-mainService deploy-mainService
   ```

7. Create a new JWS file, or update an existing one, that implements the client Web Service that invokes the reliable Web Service. This service will be deployed to the source WebLogic Server.

   See "Programming Guidelines for the JWS File That Invokes a Reliable Web Service" on page 6-14.

8. Update the `build.xml` file that builds the client Web Service.

   See "Updating the build.xml File for a Client of a Reliable Web Service" on page 6-16.

9. Compile your client JWS file by calling the appropriate target and deploy to the source WebLogic Server. For example:

```
prompt> ant build-clientService deploy-clientService
```

Configuring the Destination WebLogic Server Instance

Configuring the WebLogic Server instance on which the reliable Web Service is deployed involves configuring JMS and store and forward (SAF) resources. The following high-level procedure lists the tasks and then points to the Administration Console Online Help for details on performing the tasks.

1. Invoke the Administration Console for the domain that contains the destination WebLogic Server in your browser.

   See "Invoking the Administration Console" on page 11-4 for instructions on the URL that invokes the Administration Console.

2. Optionally create a persistent store (either file or JDBC) that will be used by the destination WebLogic Server to store internal Web Service reliable messaging information. You can use an existing one, or the default store that always exists, if you do not want to create a new one.

   See Create file stores.

3. Create a JMS Server. If a JMS server already exists, you can use it if you do not want to create a new one.

   See Create JMS servers.

4. Create a JMS module, and then define a JMS queue in the module. If a JMS module already exists, you can use it if you do not want to create a new one. Target the JMS queue to the JMS server you created in the preceding step.

Take note of the JNDI name you define for the JMS queue because you will later use it when you program the JWS file that implements your reliable Web Service.

See Create JMS modules and Create queues.

5. Create a store and forward (SAF) agent. You can use an existing one if you do not want to create a new one.

   When you create the SAF agent:

   – Set the **Agent Type** field to `Both` to enable both sending and receiving agents.

   – Be sure to target the SAF agent to your WebLogic Server instance by clicking Next on the first assistant page rather than Finish.

   See Create Store and Forward agents.

Cluster Considerations

If you are using the Web Service reliable messaging feature in a cluster, you must:

- Still create a *local* JMS queue, rather than a distributed queue, when creating the JMS queue in step 4. in "Configuring the Destination WebLogic Server Instance".
- Explicitly target this JMS queue to each server in the cluster.
- Configure a Path Service for the cluster using the Administration Console. For details, see Configure Path Services.

Configuring the Source WebLogic Server Instance

Configuring the WebLogic Server instance on which the client Web Service is deployed involves configuring JMS and store and forward (SAF) resources. The following high-level procedure lists the tasks and then points to the Administration Console online help for details on performing the tasks.

1. Invoke the Administration Console for the domain that contains the source WebLogic Server in your browser.

   See "Invoking the Administration Console" on page 11-4 for instructions on the URL that invokes the Administration Console.

2. Create a persistent store (file or JDBC) that will be used by the source WebLogic Server to store internal Web Service reliable messaging information. You can use an existing one if you do not want to create a new one.

See Create file stores.

3. Create a JMS Server. You can use an existing one if you do not want to create a new one.

   See Create JMS servers.

4. Create a store and forward (SAF) agent. You can use an existing one if you do not want to create a new one.

   Be sure when you create the SAF agent that you set the **Agent Type** field to `Both` to enable both sending and receiving agents.

   See Create Store and Forward agents.

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.

You can use one of the two default reliable messaging WS-Policy files included in WebLogic Server; these files are adequate for most use cases. However, because these files cannot be changed, if they do not suit your needs, you must create your own. See "Use of WS-Policy Files for Web Service Reliable Messaging Configuration" on page 6-2 for a description of the included WS-Policy files. The remainder of this section describes how to create your own WS-Policy file.

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:

```
<wsp:Policy
   xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm"
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
   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. The assertions that use the `beapolicy:` namespace are WebLogic-specific. See Appendix C, "Web Service Reliable Messaging Policy Assertion Reference," for details.

All Web Service reliable messaging assertions are optional, so only set those whose default values are not adequate. You can specify the following assertions:

- `<wsrm:InactivityTimeout>`—Number of milliseconds, specified with the `Milliseconds` 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.

- `<wsrm:AcknowledgmentInterval>`—Maximum interval, in milliseconds, in which the destination endpoint must transmit a stand-alone acknowledgement. The default value is set by the SAF agent on the destination endpoint's WebLogic Server instance.
- `<wsrm:BaseRetransmissionInterval>`—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.
- `<wsrm:ExponentialBackoff>`—Specifies that the retransmission interval will be adjusted using the exponential backoff algorithm. This element has no attributes.
- `<beapolicy:Expires>`—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. This element has a single attribute, `Expires`, whose data type is an XML Schema duration type. For example, if you want to set the expiration time to one day, use the following: `<beapolicy:Expires Expires="P1D" />`.
- `<beapolicy:QOS>`—Delivery assurance level, as described in "Using Web Service Reliable Messaging" on page 6-1. 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.

The following example shows a simple Web Service reliable messaging WS-Policy file:

```
<?xml version="1.0"?>

<wsp:Policy wsp:Name="ReliableHelloWorldPolicy"
   xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm"
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
   xmlns:beapolicy="http://www.bea.com/wsrm/policy">

 <wsrm:RMAssertion>

   <wsrm:InactivityTimeout
      Milliseconds="600000" />
   <wsrm:AcknowledgementInterval
      Milliseconds="2000" />
   <wsrm:BaseRetransmissionInterval
      Milliseconds="500" />
   <wsrm:ExponentialBackoff />

 </wsrm:RMAssertion>
```

```
</wsp:Policy>
```

Programming Guidelines for the Reliable JWS File

This section describes how to create the JWS file that implements the reliable Web Service.

The following JWS annotations are used in the JWS file that implements a reliable Web Service:

- `@weblogic.jws.Policy`—Required. See "Using the @Policy Annotation" on page 6-11.
- `@javax.jws.Oneway`—Required only if you are using Web Service reliable messaging on its own, without also using the asynchronous request-response feature. See "Using the @Oneway Annotation" on page 6-13 and "Using the Asynchronous Features Together" on page 6-44.
- `@weblogic.jws.BufferQueue`—Optional. See "Using the @BufferQueue Annotation" on page 6-13.
- `@weblogic.jws.ReliabilityBuffer`—Optional. See "Using the @ReliabilityBuffer Annotation" on page 6-13

The following example shows a simple JWS file that implements a reliable Web Service; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.reliable;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.Oneway;

import weblogic.jws.WLHttpTransport;

import weblogic.jws.ReliabilityBuffer;
import weblogic.jws.BufferQueue;
import weblogic.jws.Policy;

/**
 * Simple reliable Web Service.
 */

@WebService(name="ReliableHelloWorldPortType",
              serviceName="ReliableHelloWorldService")

@WLHttpTransport(contextPath="ReliableHelloWorld",
      serviceUri="ReliableHelloWorld",
      portName="ReliableHelloWorldServicePort")
```

```
@Policy(uri="ReliableHelloWorldPolicy.xml",
          direction=Policy.Direction.both,
          attachToWsdl=true)

@BufferQueue(name="webservices.reliable.queue")

public class ReliableHelloWorldImpl {

  @WebMethod()
  @Oneway()
  @ReliabilityBuffer(retryCount=10, retryDelay="10 seconds")

  public void helloWorld(String input) {
    System.out.println(" Hello World " + input);

  }
}
```

In the example, the `ReliableHelloWorldPolicy.xml` 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 policy file is applied only to the request Web Service message (as required by the reliable messaging feature) and it is attached to the WSDL file.

The JMS queue that WebLogic Server uses internally to enable the Web Service reliable messaging has a JNDI name of `webservices.reliable.queue`, as specified by the `@BufferQueue` annotation.

The `helloWorld()` method has been marked with both the `@WebMethod` and `@Oneway` JWS annotations, which means it is a public operation called `helloWorld`. Because of the `@Policy` annotation, the operation can be invoked reliably. The Web Services runtime attempts to deliver reliable messages to the service a maximum of 10 times, at 10-second intervals, as described by the `@ReliabilityBuffer` annotation. The message may require redelivery if, for example, the transation is rolled back or otherwise does not commit.

Using the @Policy Annotation

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.

See "Use of WS-Policy Files for Web Service Reliable Messaging Configuration" on page 6-2 for descriptions of the two WS-Policy files (`DefaultReliability.xml` and `LongRunningReliability.xml`) included in WebLogic Server that you can use instead of writing your own.

You must follow these requirements when using the `@Policy` annotation for Web Service reliable messaging:

- Specify the `@Policy` annotation *only* at the class-level.
- Because Web Service reliable messaging is applied to both the request and response SOAP message, set the `direction` attribute of the `@Policy` annotation only to its default value: `Policy.Direction.both`.

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="ReliableHelloWorldPolicy.xml",
          direction=Policy.Direction.both,
          attachToWsdl=true)
```

  The example shows that the `ReliableHelloWorldPolicy.xml` file is located in the same directory as the JWS file.

- To specify that the Web Service is going to use a WS-Policy file that is part of WebLogic Server, 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. Use this syntax when specifying one of the pre-packaged WS-Policy files or when specifying a WS-Policy file that is packaged in a shared J2EE library.

  Note: Shared J2EE 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 J2EE 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 J2EE Libraries and Optional Packages at http://e-docs.bea.com/wls/docs90/programming/libraries.html for information on creating libraries and setting up your environment so the Web Service can find the policy files.

- To specify that the policy file is published somewhere 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"
        direction=Policy.Direction.both,
        attachToWsdl=true)
```

You can also set the `attachToWsd` 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`.

Using the @Oneway Annotation

If you plan on invoking the reliable Web Service operation synchronously (or in other words, *not* using the asynchronous request-response feature), then the implementing method is required to be annotated with the `@Oneway` annotation to specify that the method is one-way. This means that the method cannot return a value, but rather, must explicitly return `void`.

Conversely, if the method is *not* annotated with the `@Oneway` annotation, then you must invoke it using the asynchronous request-response feature. If you are unsure how the operation is going to be invoked, consider creating two flavors of the operation: synchronous and asynchronous.

See "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17 and "Using the Asynchronous Features Together" on page 6-44.

Using the @BufferQueue Annotation

Use the `@BufferQueue` annotation to specify the JNDI name of the JMS queue which WebLogic Server uses to store reliable messages internally. The JNDI name is the one you configured when creating a JMS queue in step 4. in "Configuring the Destination WebLogic Server Instance".

The `@BufferQueue` annotation is optional; if you do not specify it in your JWS file then WebLogic Server uses a queue with a JNDI name of `weblogic.wsee.DefaultQueue`. You must, however, still explicitly create a JMS queue with this JNDI name using the Administration Console.

Using the @ReliabilityBuffer Annotation

Use this annotation to specify the number of times WebLogic Server should attempt to deliver the message from the JMS queue to the Web Service implementation (default 3) and the amount of time that the server should wait in between retries (default 5 seconds).

Use the `retryCount` attribute to specify the number of retries and the `retryDelay` attribute to specify the wait time. The format of the `retryDelay` attribute is a number and then one of the following strings:

- `seconds`
- `minutes`
- `hours`
- `days`

- `years`

For example, to specify a retry count of 20 and a retry delay of two days, use the following syntax:

```
@ReliabilityBuffer(retryCount=20, retryDelay="2 days")
```

Programming Guidelines for the JWS File That Invokes a Reliable Web Service

If you are using the WebLogic client APIs, you must invoke a reliable Web Service from within a Web Service; you cannot invoke a reliable Web Service from a stand-alone client application.

The following example shows a simple JWS file for a Web Service that invokes a reliable operation from the service described in "Programming Guidelines for the Reliable JWS File" on page 6-10; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.reliable;

import java.rmi.RemoteException;

import javax.jws.WebMethod;
import javax.jws.WebService;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.ServiceClient;

import examples.webservices.reliable.ReliableHelloWorldPortType;

@WebService(name="ReliableClientPortType",
            serviceName="ReliableClientService")

@WLHttpTransport(contextPath="ReliableClient",
                 serviceUri="ReliableClient",
                 portName="ReliableClientServicePort")

public class ReliableClientImpl

{
  @ServiceClient(

wsdlLocation="http://localhost:7001/ReliableHelloWorld/ReliableHelloWorld?WSDL
",
     serviceName="ReliableHelloWorldService",
     portName="ReliableHelloWorldServicePort")

  private ReliableHelloWorldPortType port;
```

```
  @WebMethod
  public void callHelloWorld(String input, String serviceUrl)
     throws RemoteException {

    port.helloWorld(input);

    System.out.println(" Invoked the ReliableHelloWorld.helloWorld operation
reliably." );

  }
}
```

Follow these guidelines when programming the JWS file that invokes a reliable Web Service; code snippets of the guidelines are shown in bold in the preceding example:

- Import the `@ServiceClient` JWS annotation:

  ```
  import weblogic.jws.ServiceClient;
  ```

- Import the JAX-RPC stub, created later by the `clientgen` Ant task, of the port type of the reliable Web Service you want to invoke. The stub package is specified by the `packageName` attribute of `clientgen`, and the name of the stub is determined by the WSDL of the invoked Web Service.

  ```
  import examples.webservices.reliable.ReliableHelloWorldPortType;
  ```

- In the body of the JWS file, use the `@ServiceClient` JWS annotation to specify the WSDL, name, and port of the reliable Web Service you want to invoke. You specify this annotation at the field-level on a private variable, whose data type is the JAX-RPC port type of the Web Service you are invoking.

  ```
  @ServiceClient(

  wsdlLocation="http://localhost:7001/ReliableHelloWorld/ReliableHelloWor
  ld?WSDL",
       serviceName="ReliableHelloWorldService",
       portName="ReliableHelloWorldServicePort")

    private ReliableHelloWorldPortType port;
  ```

- Using the stub you annotated with the `@ServiceClient` annotation, invoke the reliable operation:

  ```
        port.helloWorld(input);
  ```

  Because the operation has been marked one-way, it does not return a value.

Updating the build.xml File for a Client of a Reliable Web Service

To update a `build.xml` file to generate the JWS file that invokes the operation of a reliable Web Service, add `taskdefs` and a `build-reliable-client` targets that look something like the following; see the description after the example for details:

```
    <path id="ws.client.class.path">
      <pathelement path="${tempjar-dir}"/>
      <pathelement path="${java.class.path}"/>
    </path>

  <taskdef name="jwsc"
      classname="weblogic.wsee.tools.anttasks.JwscTask" />

  <taskdef name="clientgen"
      classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

    <target name="build-reliable-client">

      <clientgen

  wsdl="http://${wls.destination.host}:${wls.destination.port}/ReliableHe
  lloWorld/ReliableHelloWorld?WSDL"
        destDir="${tempjar-dir}"
        packageName="examples.webservices.reliable"/>

      <javac
        source="1.5"
        srcdir="${tempjar-dir}"
        destdir="${tempjar-dir}"
        includes="**/*.java"/>

      <jwsc
          srcdir="src"
          destdir="${client-ear-dir}"
          classpathref="ws.client.class.path">

          <jws
           file="examples/webservices/reliable/ReliableClientImpl.java"/>
      </jwsc>

      <copy todir="${client-ear-dir}/app-inf/classes">
           <fileset dir="${tempjar-dir}" />
      </copy>

    </target>
```

Use the `taskdef` Ant task to define the full classname of the `jwsc` and `clientgen` Ant tasks.

Before running the `jwsc` Ant task, you must first use `clientgen` to generate and compile the JAX-RPC stubs for the deployed `ReliableHelloWorld` Web Service. You do this because the `ReliableClientImpl` JWS file imports and uses one of the generated classes, and the `jwsc` task fails if the classes do not already exist. When you execute the `jwsc` Ant task, use the `classpathref` attribute to add to the CLASSPATH the temporary directory into which `clientgen` generated its artifacts.

After `jwsc` has generated all its artifacts into the EAR directory, use the `copy` Ant task to copy the `clientgen`-generated artifacts into the `APP-INF/classes` directory of the EAR so that the `ReliableClientService` Web Service can find them.

Note: The `APP-INF/classes` directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

Invoking a Web Service Using Asynchronous Request-Response

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, or in other words, use the asynchronous request-response feature of WebLogic Web Services.

You invoke a Web Service asynchronously only from a client running in a WebLogic Web Service, never from a stand alone client application. The invoked Web Service does not change in any way, thus you can invoke any deployed Web Service (both WebLogic and non-WebLogic) asynchronously as long as the application server that hosts the Web Service supports the WS-Addressing specification.

When implementing asynchronous request-response in your client, rather than invoking the operation directly, you invoke an asynchronous flavor of the same operation. (This asynchronous flavor of the operation is automatically generated by the `clientgen` Ant task.) For example, rather than invoking an operation called `getQuote` directly, you would invoke `getQuoteAsync` instead. The asynchronous flavor of the operation always returns `void`, even if the original operation returns a value. You then include methods in your client that handle the asynchronous response or failures when it returns later on. You put any business logic that processes the return value of the Web Service operation invoke or a potential failure in these methods. You use both naming conventions and JWS annotations to specify these methods to the JWS compiler. For example, if the asynchronous operation is called `getQuoteAsync`, then these methods might be called `onGetQuoteAsyncResponse` and `onGetQuoteAsyncFailure`.

Note: For information about using asynchronous request-response with other asynchronous features, such as Web Service reliable messaging or buffering, see "Using the Asynchronous Features Together" on page 6-44. This section describes how to use the asynchronous request-response feature on its own.

Note: The asynchronous request-response feature works only with HTTP; you cannot use it with the HTTPS or JMS transport.

Using Asynchronous Request-Response: Main Steps

The following procedure describes how to create a client Web Service that asynchronously invokes an operation in a different Web Service. The procedure shows how to create the JWS file that implements the client Web Service from scratch; if you want to update an existing JWS file, use this procedure as a guide.

For clarity, it is assumed in the procedure that:

- The client Web Service is called `StockQuoteClientService`.
- The `StockQuoteClientService` service is going to invoke the `getQuote(String)` operation of the already-deployed `StockQuoteService` service whose WSDL is found at the following URL:

```
http://localhost:7001/async/StockQuote?WSDL
```

It is further 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 generated service. See Chapter 3, "Common Web Services Use Cases and Examples," Chapter 4, "Iterative Development of WebLogic Web Services," and Chapter 5, "Programming the JWS File."

1. Using your favorite IDE or text editor, create a new JWS file, or update an existing one, that implements the `StockQuoteClientService` Web Service.

   See "Writing the Asynchronous JWS File" on page 6-19.

2. Update your `build.xml` file to run the `clientgen` Ant task against the `StockQuoteService` Web Service and to compile the JWS file that implements the `StockQuoteClientService`. The `clientgen` Ant task automatically generates the asynchronous flavor of the Web Service operations you are invoking.

   See "Updating the build.xml File When Using Asynchronous Request-Response" on page 6-24.

3. Run the Ant target to build the `StockQuoteClientService`:

```
prompt> ant build-clientService
```

4. Deploy the `StockQuoteClientService` Web Service as usual.

   See "Deploying and Undeploying WebLogic Web Services" on page 4-13.

When you invoke the `StockQuoteClientService` Web Service, which in turn invokes the `StockQuoteService` Web Service, the second invoke will be asynchronous rather than synchronous.

Writing the Asynchronous JWS File

The following example shows a simple JWS file that implements a Web Service called `StockQuoteClient` that has a single method, `asyncOperation`, that in turn asynchronously invokes the `getQuote` method of the `StockQuote` service. The Java code in bold is described "Coding Guidelines for Invoking a Web Service Asynchronously" on page 6-20. See "Example of a Synchronous Invoke" on page 6-23 to see how the asynchronous invoke differs from a synchronous invoke of the same operation.

```
package examples.webservices.async_req_res;

import weblogic.jws.WLHttpTransport;

import weblogic.jws.ServiceClient;
import weblogic.jws.AsyncResponse;
import weblogic.jws.AsyncFailure;

import weblogic.wsee.async.AsyncPreCallContext;
import weblogic.wsee.async.AsyncCallContextFactory;
import weblogic.wsee.async.AsyncPostCallContext;

import javax.jws.WebService;
import javax.jws.WebMethod;

import examples.webservices.async_req_res.StockQuotePortType;

import java.rmi.RemoteException;

@WebService(name="StockQuoteClientPortType",
            serviceName="StockQuoteClientService",
            targetNamespace="http://examples.org/")

@WLHttpTransport(contextPath="asyncClient",
                 serviceUri="StockQuoteClient",
                 portName="StockQuoteClientServicePort")
```

```
/**
 *  Client Web Service that invokes the StockQuote Service asynchronously.
 */

public class StockQuoteClientImpl {

  @ServiceClient(wsdlLocation="http://localhost:7001/async/StockQuote?WSDL",
                 serviceName="StockQuoteService", portName="StockQuote")

  private StockQuotePortType port;

  @WebMethod
  public void asyncOperation (String symbol) throws RemoteException {

    AsyncPreCallContext apc = AsyncCallContextFactory.getAsyncPreCallContext();
    apc.setProperty("symbol", symbol);

    try {
      port.getQuoteAsync(apc, symbol );
      System.out.println("in getQuote method of StockQuoteClient WS");

     } catch (RemoteException re) {

        System.out.println("RemoteException thrown");
        throw new RuntimeException(re);
    }

  }

  @AsyncResponse(target="port", operation="getQuote")
  public void onGetQuoteAsyncResponse(AsyncPostCallContext apc, int quote) {
    System.out.println("-------------------");
    System.out.println("Got quote " + quote );
    System.out.println("-------------------");
  }

  @AsyncFailure(target="port", operation="getQuote")
  public void onGetQuoteAsyncFailure(AsyncPostCallContext apc, Throwable e) {
    System.out.println("-------------------");
    e.printStackTrace();
    System.out.println("-------------------");
  }

}
```

Coding Guidelines for Invoking a Web Service Asynchronously

The following guidelines for invoking an operation asynchronously correspond to the Java code shown in bold in the example described in "Writing the Asynchronous JWS File" on page 6-19. These guidelines are in addition to the standard ones for creating JWS files. See "Example of a

Synchronous Invoke" on page 6-23 to see how the asynchronous invoke differs from a synchronous invoke of the same operation.

To invoke an operation asynchronously in your JWS file:

- Import the following WebLogic-specific JWS annotations related to the asynchronous request-response feature:

```
import weblogic.jws.ServiceClient;
import weblogic.jws.AsyncResponse;
import weblogic.jws.AsyncFailure;
```

- Import the JAX-RPC stub, created later by the `clientgen` Ant task, of the port type of the Web Service you want to invoke. The stub package is specified by the `packageName` attribute of `clientgen`, and the name of the stub is determined by the WSDL of the invoked Web Service.

```
import examples.webservices.async_req_res.StockQuotePortType;
```

- Import the asynchronous pre- and post-call context WebLogic APIs:

```
import weblogic.wsee.async.AsyncCallContextFactory;
import weblogic.wsee.async.AsyncPreCallContext;
import weblogic.wsee.async.AsyncPostCallContext;
```

  The `AsyncPreCallContext` and `AsyncPostCallContext` APIs describe asynchronous contexts that you can use for a variety of reasons in your Web Service: to set a property in the pre-context so that the method that handles the asynchronous response can distinguish between different asynchronous calls; to set and get contextual variables, such as the name of the user invoking the operation, their password, and so on; to get the name of the JAX-RPC stub that invoked a method asynchronously; and to set a timeout interval on the context.

  See Javadocs for additional reference information about these APIs.

- In the body of the JWS file, use the required `@ServiceClient` JWS annotation to specify the WSDL, name, and port of the Web Service you will be invoking asynchronously. You specify this annotation at the field-level on a variable, whose data type is the JAX-RPC port type of the Web Service you are invoking.

```
@ServiceClient(
     wsdlLocation="http://localhost:7001/async/StockQuote?WSDL",
     serviceName="StockQuoteService",
     portName="StockQuote")

private StockQuotePortType port;
```

When you annotate a variable (in this case, `port`) with the `@ServiceClient` annotation, the Web Services runtime automatically initializes and instantiates the variable, preparing it so that it can be used to invoke another Web Service asynchronously.

- In the method of the JWS file which is going to invoke the `getQuote` operation asynchronously, get a pre-call asynchronous context using the context factory:

```
AsyncPreCallContext apc =
    AsyncCallContextFactory.getAsyncPreCallContext();
```

- Use the `setProperty` method of the pre-call context to create a property whose name and value is the same as the parameter to the `getQuote` method:

```
apc.setProperty("symbol", symbol);
```

- Using the stub you annotated with the `@ServiceClient` annotation, invoke the operation (in this case, `getQuote`). Instead of invoking it directly, however, invoke the asynchronous flavor of the operation, which has `Async` added on to the end of its name. The asynchronous flavor always returns `void`. Pass the asynchronous context as the first parameter:

```
port.getQuoteAsync(apc, symbol);
```

- For each operation you will be invoking asynchronously, create a method called `on`*`Operationname`*`AsyncResponse`, where *`Operationname`* refers to the name of the operation, with initial letter always capitalized. The method must return `void`, and have two parameters: the post-call asynchronous context and the return value of the operation you are invoking. Annotate the method with the `@AsyncResponse` JWS annotation; use the `target` attribute to specify the variable whose datatype is the JAX-RPC stub and the `operation` attribute to specify the name of the operation you are invoking asynchronously. Inside the body of the method, put the business logic that processes the value returned by the operation.

```
  @AsyncResponse(target="port", operation="getQuote")
  public void onGetQuoteAsyncResponse(AsyncPostCallContext apc,
       int quote) {
    System.out.println("-------------------");
    System.out.println("Got quote " + quote );
    System.out.println("-------------------");
  }
```

- For each operation you will be invoking asynchronously, create a method called `on`*`Operationname`*`AsyncFailure`, where *`Operationname`* refers to the name of the operation, with initial letter capitalized. The method must return `void`, and have two parameters: the post-call asynchronous context and a `Throwable` object, the superclass of all exceptions to handle any type of exception thrown by the invoked operation. Annotate the method with the `@AsyncFailure` JWS annotation; use the `target` attribute to specify the variable whose datatype is the JAX-RPC stub and the `operation` attribute to specify the name of the operation you are invoking asynchronously. Inside the method, you can determine the exact nature of the exception and write appropriate Java code.

```
@AsyncFailure(target="port", operation="getQuote")
public void onGetQuoteAsyncFailure(AsyncPostCallContext apc,
    Throwable e) {
  System.out.println("-------------------");
  e.printStackTrace();
  System.out.println("-------------------");
}
```

Note: You are not required to use the `@AsyncResponse` and `@AsyncFailure` annotations, although it is a good practice because it clears up any ambiguity and makes your JWS file clean and understandable. However, in the rare use case where you want one of the `onXXX` methods to handle the asynchronous response or failure from two (or more) stubs that are invoking operations from two different Web Services that have the same name, then you should explicitly NOT use these annotations. Be sure that the name of the `onXXX` methods follow the correct naming conventions exactly, as described above.

Example of a Synchronous Invoke

The following example shows a JWS file that invokes the `getQuote` operation of the `StockQuote` Web Service synchronously. The example is shown only so you can compare it with the corresponding asynchronous invoke shown in "Writing the Asynchronous JWS File" on page 6-19.

```
package examples.webservices.async_req_res;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.ServiceClient;

import javax.jws.WebService;
import javax.jws.WebMethod;

import java.rmi.RemoteException;

@WebService(name="SyncClientPortType",
            serviceName="SyncClientService",
            targetNamespace="http://examples.org/")

@WLHttpTransport(contextPath="syncClient",
                 serviceUri="SyncClient",
                 portName="SyncClientPort")

/**
 *  Normal ole service-to-service client that invokes StockQuote service
```

```
 *  synchronously.
 */

public class SyncClientImpl {

  @ServiceClient(wsdlLocation="http://localhost:7001/async/StockQuote?WSDL",
                 serviceName="StockQuoteService", portName="StockQuote")
  private StockQuotePortType port;

  @WebMethod
  public void nonAsyncOperation(String symbol) throws RemoteException {

    int quote = port.getQuote(symbol);

    System.out.println("-------------------");
    System.out.println("Got quote " + quote );
    System.out.println("-------------------");

  }

}
```

Updating the build.xml File When Using Asynchronous Request-Response

To update a `build.xml` file to generate the JWS file that invokes a Web Service operation asynchronously, add `taskdefs` and a `build-clientService` target that looks something like the following; see the description after the example for details:

```
<path id="ws.clientService.class.path">
    <pathelement path="${tempjar-dir}"/>
    <pathelement path="${java.class.path}"/>
</path>

<taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

<taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

  <target name="build-clientService">

    <clientgen
      wsdl="http://${wls.hostname}:${wls.port}/async/StockQuote?WSDL"
      destDir="${tempjar-dir}"
      packageName="examples.webservices.async_req_res"/>

    <javac
      source="1.5"
      srcdir="${tempjar-dir}"
```

```
        destdir="${tempjar-dir}"
        includes="**/*.java"/>

      <jwsc
          srcdir="src"
          destdir="${clientService-ear-dir}"
          classpathref="ws.clientService.class.path">

          <jws

file="examples/webservices/async_req_res/StockQuoteClientImpl.java" />

      </jwsc>

      <copy todir="${clientService-ear-dir}/app-inf/classes">
           <fileset dir="${tempjar-dir}" />
      </copy>

    </target>
```

Use the `taskdef` Ant task to define the full classname of the `jwsc` and `clientgen` Ant tasks.

Before running the `jwsc` Ant task, you must first use `clientgen` to generate and compile the JAX-RPC stubs for the deployed `StockQuote` Web Service; this is because the `StockQuoteClientImpl` JWS file imports and uses the generated classes, and the `jwsc` task will fail if the classes does not already exist. By default, the `clientgen` Ant task generates both synchronous and asynchronous flavors of the Web Service operations in the JAX-RPC stubs. When you execute the `jwsc` Ant task, use the `classpathref` attribute to add to the CLASSPATH the temporary directory into which `clientgen` generated its artifacts.

After `jwsc` has generated all its artifacts into the EAR directory, use the `copy` Ant task to copy the `clientgen`-generated artifacts into the `APP-INF/classes` directory of the EAR so that the `StockQuoteClient` Web Service can find them.

Note: The `APP-INF/classes` directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

Creating Conversational Web Services

A Web Service and the client application that invokes it may communicate multiple times to complete a single task. Also, multiple client applications might communicate with the same Web Service at the same time. *Conversations* provide a straightforward way to keep track of data between calls and to ensure that the Web Service always responds to the correct client.

Conversations meet two challenges inherent in persisting data across multiple communications:

- Conversations uniquely identify a two-way communication between one client application and one Web Service so that messages are always returned to the correct client. For example, in a shopping cart application, a conversational Web Service keeps track of which shopping cart belongs to which customer. A conversational Web Service implements this by creating a unique conversation ID each time a new conversation is started with a client application.
- Conversations maintain state between calls to the Web Service; that is, they keep track of the data associated with a particular client application between its calls to the service. Conversations ensure that the data associated with a particular client is saved until it is no longer needed or the operation is complete. For example, in a shopping cart application, a conversational Web Service remembers which items are in the shopping cart while the customer continues shopping. Maintaining state is also needed to handle failure of the computer hosting the Web Service in the middle of a conversation; all state-related data is persisted to disk so that when the computer comes up it can continue the conversation with the client application.

WebLogic Server manages this unique ID and state by creating a conversation context each time a client application initiates a new conversation. The Web Service then uses the context to correlate calls to and from the service and to persist its state-related data.

Conversations between a client application and a Web Service have three distinct phases:

- Start—A client application initiates a conversation by invoking the start operation of the conversational Web Service. The Web Service in turn creates a new conversation context and an accompanying unique ID, and starts an internal timer to measure the idle time and the age of the conversation.
- Continue—After the client application has started the conversation, it invokes one or more continue operations to continue the conversation. The conversational Web Service uses the ID associated with the invoke to determine which client application it is conversing with, what state to persist, and which idle timer to reset. A typical continue operation would be one that requests more information from the client application, requests status, and so on.
- Finish—A client application explicitly invokes the finish operation when it has finished its conversation; the Web Service then marks any data or resources associated with the conversation as deleted.

Conversations typically occur between two WebLogic Web Services: one is marked conversational and defines the start, continue, and finish operations and the other Web Service uses the `@ServiceClient` annotation to specify that it is a client of the conversational Web Service. You can also invoke a conversational Web Service from a stand-alone Java client, although there are restrictions.

As with other WebLogic Web Service features, you use JWS annotations to specify that a Web Service is conversational.

Caution: A conversational Web Service on its own does not guarantee message delivery or that the messages are delivered in order, exactly once. If you require this kind of message delivery guarantee, you must also specify that the Web Service be reliable. See "Using Web Service Reliable Messaging" on page 6-1 and "Using the Asynchronous Features Together" on page 6-44.

Creating a Conversational Web Service: Main Steps

The following procedure describes how to create a conversational Web Service, as well as a client Web Service and stand-alone Java client application, both of which initiate and conduct a conversation. The procedure shows how to create the JWS files that implement the two Web Services 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 generated conversational Web Service. It is further assumed that you have a similar setup for the WebLogic Server instance that hosts the client Web Service that initiates the conversation. For more information, see Chapter 3, "Common Web Services Use Cases and Examples," Chapter 4, "Iterative Development of WebLogic Web Services," and Chapter 5, "Programming the JWS File.".

1. Using your favorite IDE or text editor, create a new JWS file, or update an existing one, that implements the conversational Web Service.

   See "Programming Guidelines for the Conversational JWS File" on page 6-28.

2. Update your `build.xml` file to include a call to the `jwsc` Ant task to compile the conversational JWS file into a Web Service.

   See "Running the jwsc WebLogic Web Services Ant Task" on page 4-6.

3. Run the Ant target to build the conversational Web Service. For example:

   ```
   prompt> ant build-mainService
   ```

4. Deploy the Web Service as usual.

   See "Deploying and Undeploying WebLogic Web Services" on page 4-13.

5. If the client application is a stand-alone Java client, see "Updating a Stand-Alone Java Client to Invoke a Conversational Web Service" on page 6-36. If the client application is itself a Web Service, follow these steps:

   a. Using your favorite IDE or text editor, create a new JWS file, or update an existing one, that implements the client Web Service that initiates and conducts the conversation with the conversational Web Service. It is assumed that the client Web Service is deployed to a different WebLogic Server instance from the one that hosts the conversational Web Service.

      See "Programming Guidelines for the JWS File That Invokes a Conversational Web Service" on page 6-32.

   b. Update the `build.xml` file that builds the client Web Service.

      See "Updating the build.xml File for a Client of a Conversational Web Service" on page 6-34.

   c. Run the Ant target to build the client Web Service:

      ```
      prompt> ant build-clientService
      ```

   d. Deploy the Web Service as usual.

      See "Deploying and Undeploying WebLogic Web Services" on page 4-13.

Programming Guidelines for the Conversational JWS File

The following example shows a simple JWS file that implements a conversational Web Service; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.conversation;

import java.io.Serializable;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.Conversation;
import weblogic.jws.Conversational;
import weblogic.jws.Context;

import weblogic.wsee.jws.JwsContext;
import weblogic.wsee.jws.ServiceHandle;

import javax.jws.WebService;
import javax.jws.WebMethod;
```

```
@Conversational(maxIdleTime="10 minutes",
                maxAge="1 day",
                runAsStartUser=false,
                singlePrincipal=false )

@WebService(name="ConversationalPortType",
            serviceName="ConversationalService",
            targetNamespace="http://examples.org/")

@WLHttpTransport(contextPath="conv",
                 serviceUri="ConversationalService",
                 portName="ConversationalServicePort")

/**
 * Conversational Web Service.
 */

public class ConversationalServiceImpl implements Serializable {

  @Context
  private JwsContext ctx;
  public String status = "undefined";

  @WebMethod
  @Conversation (Conversation.Phase.START)
  public String start() {

    ServiceHandle handle = ctx.getService();
    String convID = handle.getConversationID();

    status = "start";
    return "Starting conversation, with ID " + convID + " and status equal to "
+ status;

  }

  @WebMethod
  @Conversation (Conversation.Phase.CONTINUE)
  public String middle(String message) {

    status = "middle";
    return "Middle of conversation; the message is: " + message + " and status
is " + status;

  }

  @WebMethod
  @Conversation (Conversation.Phase.FINISH)
  public String finish(String message ) {
```

```
    status = "finish";
    return "End of conversation; the message is: " + message + " and status is
" + status;

  }

}
```

Follow these guidelines when programming the JWS file that implements a conversational Web Service. Code snippets of the guidelines are shown in bold in the preceding example.

- Conversational Web Services must implement `java.io.Serializable`, so you must first import the class into your JWS file:

  ```
  import java.io.Serializable;
  ```

- Import the conversational JWS annotations:

  ```
  import weblogic.jws.Conversation;
  import weblogic.jws.Conversational;
  ```

- If you want to access runtime information about the conversational Web Service, import the `@Context` annotation and context APIs:

  ```
  import weblogic.jws.Context;

  import weblogic.wsee.jws.JwsContext;
  import weblogic.wsee.jws.ServiceHandle;
  ```

  See "Accessing Runtime Information about a Web Service Using the JwsContext" on page 5-10 for more information about the runtime Web Service context.

- Use the class-level `@Conversational` annotation to specify that the Web Service is conversational. Although this annotation is optional (assuming you *are* specifying the `@Conversation` method-level annotation), it is a best practice to always use it in your JWS file to clearly specify that your Web Service is conversational.

  Specify any of the following optional attributes: `maxIdleTime` is the maximum amount of time that the Web Service can be idle before WebLogic Server finishes the conversation; `maxAge` is the maximum age of the conversation; `runAsStartUser` indicates whether the continue and finish phases of an existing conversation are run as the user who started the conversation; and `singlePrincipal` indicates whether users other than the one who started a conversation are allowed to execute the continue and finish phases of the conversation.

  ```
  @Conversational(maxIdleTime="10 minutes",
                  maxAge="1 day",
                  runAsStartUser=false,
                  singlePrincipal=false )
  ```

If a JWS file includes the `@Conversational` annotation, all operations of the Web Service are conversational. The default phase of an operation, if it does not have an explicit `@Conversation` annotation, is continue. However, because a conversational Web Service is required to include at least one start and one finish operation, you *must* use the method-level `@Conversation` annotation to specify which methods implement these operations.

See "weblogic.jws.Conversational" on page B-27 for additional information and default values for the attributes.

- Your JWS file must implement `java.io.Serializable`:

  ```
  public class ConversationalServiceImpl implements Serializable {
  ```

- To access runtime information about the Web Service, annotate a private class variable, of data type `weblogic.wsee.jws.JwsContext`, with the field-level `@Context` JWS annotation:

  ```
  @Context
  private JwsContext ctx;
  ```

- Use the `@Conversation` annotation to specify the methods that implement the start, continue, and finish phases of your conversation. A conversation is required to have at least one start and one finish operation; the continue operation is optional. Use the following parameters to the annotation to specify the phase: `Conversation.Phase.START`, `Conversation.Phase.CONTINUE`, or `Conversation.Phase.FINISH`. The following example shows how to specify the start operation:

  ```
  @WebMethod
  @Conversation (Conversation.Phase.START)
  public String start() {...
  ```

  If you mark just one method of the JWS file with the `@Conversation` annotation, then the entire Web Service becomes conversational and each operation is considered part of the conversation; this is true even if you have not used the optional class-level `@Conversational` annotation in your JWS file. Any methods not explicitly annotated with `@Conversation` are, by default, continue operations. This means that, for example, if a client application invokes one of these continue methods without having previously invoked a start operation, the Web Service returns a runtime error.

  Finally, if you plan to invoke the conversational Web Service from a stand-alone Java client, the start operation is required to be request-response, or in other words, it *cannot* be annotated with the `@Oneway` JWS annotation. The operation can return `void`. If you are going to invoke the Web Service only from client applications that run in WebLogic Server, then this requirement does not apply.

See “weblogic.jws.Conversation” on page B-25 for additional information.

- Use the `JwsContext` instance to get runtime information about the Web Service.

  For example, the following code in the start operation gets the ID that WebLogic Server assigns to the new conversation:

  ```
  ServiceHandle handle = ctx.getService();
  String convID = handle.getConversationID();
  ```

  See “Accessing Runtime Information about a Web Service Using the JwsContext” on page 5-10 for detailed information on using the context-related APIs.

Programming Guidelines for the JWS File That Invokes a Conversational Web Service

The following example shows a simple JWS file for a Web Service that invokes the conversational Web Service described in “Programming Guidelines for the Conversational JWS File” on page 6-28; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.conversation;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.ServiceClient;

import javax.jws.WebService;
import javax.jws.WebMethod;

import examples.webservices.conversation.ConversationalPortType;

import java.rmi.RemoteException;

@WebService(name="ConversationalClientPortType",
            serviceName="ConversationalClientService",
            targetNamespace="http://examples.org/")

@WLHttpTransport(contextPath="convClient",
                 serviceUri="ConversationalClient",
                 portName="ConversationalClientPort")

/**
 *  client that has a conversation with the ConversationalService.
 */

public class ConversationalClientImpl {

  @ServiceClient(
     wsdlLocation="http://localhost:7001/conv/ConversationalService?WSDL",
```

```
    serviceName="ConversationalService",
    portName="ConversationalServicePort")

  private ConversationalPortType port;

  @WebMethod
  public void runConversation(String message) {

    try {

      // Invoke start operation
      String result = port.start();
      System.out.println("start method executed.");
      System.out.println("The message is: " + result);

      // Invoke continue operation
      result = port.middle(message );
      System.out.println("middle method executed.");
      System.out.println("The message is: " + result);

      // Invoke finish operation
      result = port.finish(message );
      System.out.println("finish method executed.");
      System.out.println("The message is: " + result);

    }
    catch (RemoteException e) {
      e.printStackTrace();
    }

  }

}
```

Follow these guidelines when programming the JWS file that invokes a conversational Web Service; code snippets of the guidelines are shown in bold in the preceding example:

- Import the `@ServiceClient` JWS annotation:

  ```
  import weblogic.jws.ServiceClient;
  ```

- Import the JAX-RPC stub of the port type of the conversational Web Service you want to invoke. The actual stub itself will be created later by the `clientgen` Ant task. The stub package is specified by the `packageName` attribute of `clientgen`, and the name of the stub is determined by the WSDL of the invoked Web Service.

  ```
  import examples.webservices.conversation.ConversationalPortType;
  ```

- In the body of the JWS file, use the `@ServiceClient` JWS annotation to specify the WSDL, name, and port of the conversational Web Service you want to invoke. You specify this annotation at the field-level on a private variable, whose data type is the JAX-RPC port type of the Web Service you are invoking.

```
@ServiceClient(

wsdlLocation="http://localhost:7001/conv/ConversationalService?WSDL",
     serviceName="ConversationalService",
     portName="ConversationalServicePort")

  private ConversationalPortType port;
```

- Using the stub you annotated with the `@ServiceClient` annotation, invoke the start operation of the conversational Web Service to start the conversation. You can invoke the start method from any location in the JWS file (constructor, method, and so on):

```
      String result = port.start();
```

- Optionally invoke the continue methods to continue the conversation. Be sure you use the same stub instance so that you continue the same conversation you started:

```
result = port.middle(message );
```

- Once the conversation is completed, invoke the finish operation so that the conversational Web Service can free up the resources it used for the current conversation:

```
result = port.finish(message );
```

Updating the build.xml File for a Client of a Conversational Web Service

You update a `build.xml` file to generate the JWS file that invokes a conversational Web Service by adding `taskdefs` and a `build-clientService` target that looks something like the following example. See the description after the example for details.

```
<path id="ws.clientService.class.path">
    <pathelement path="${tempjar-dir}"/>
    <pathelement path="${java.class.path}"/>
</path>

<taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

<taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

  <target name="build-clientService">

    <clientgen
```

```
wsdl="http://${wls.hostname}:${wls.port}/conv/ConversationalService?WSD
L"
      destDir="${tempjar-dir}"
      packageName="examples.webservices.conversation"/>

    <javac
      source="1.5"
      srcdir="${tempjar-dir}" destdir="${tempjar-dir}"
      includes="**/*.java"/>

    <jwsc
        srcdir="src"
        destdir="${clientService-ear-dir}"
        classpathref="ws.clientService.class.path">

        <jws

file="examples/webservices/conversation/ConversationalClientImpl.java"
        />

    </jwsc>

    <copy todir="${clientService-ear-dir}/APP-INF/classes">
         <fileset dir="${tempjar-dir}" />
    </copy>

  </target>
```

Use the `taskdef` Ant task to define the full classname of the `jwsc` and `clientgen` Ant tasks.

Before running the `jwsc` Ant task, you must first use `clientgen` to generate and compile the JAX-RPC stubs for the deployed `ConversationalService` Web Service; this is because the `ConversationalClientImpl` JWS file imports and uses the generated classes, and the `jwsc` task fails if the classes do not already exist. When you execute the `jwsc` Ant task, use the `classpathref` attribute to add to the CLASSPATH the temporary directory into which `clientgen` generated its artifacts.

After `jwsc` has generated all its artifacts into the EAR directory, use the `copy` Ant task to copy the `clientgen`-generated artifacts into the `APP-INF/classes` directory of the EAR so that the `ConversationalClientService` Web Service can find them.

Note: The `APP-INF/classes` directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

Updating a Stand-Alone Java Client to Invoke a Conversational Web Service

The following example shows a simple stand-alone Java client that invokes the conversational Web Service described in "Programming Guidelines for the Conversational JWS File" on page 6-28. See the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.conv_standalone.client;

import java.rmi.RemoteException;

import javax.xml.rpc.ServiceException;
import javax.xml.rpc.Stub;

import weblogic.wsee.jaxrpc.WLStub;

/**
 * stand-alone client that invokes and converses with ConversationlService.
 */

public class Main {

  public static void main(String[] args)
      throws ServiceException, RemoteException{

      ConversationalService service = new ConversationalService_Impl(args[0] +
"?WSDL");
      ConversationalPortType port = service.getConversationalServicePort();

      // Set property on stub to specify that client is invoking a Web Service
      // that uses advanced features; this property is automatically set if
      // the client runs in a WebLogic Server instance.

      Stub stub = (Stub)port;
      stub._setProperty(WLStub.COMPLEX,  "true");

      // Invoke start operation to begin the conversation
      String result = port.start();
      System.out.println("start method executed.");
      System.out.println("The message is: " + result);

      // Invoke continue operation
      result = port.middle("middle" );
      System.out.println("middle method executed.");
      System.out.println("The message is: " + result);

      // Invoke finish operation
      result = port.finish("finish" );
```

```
        System.out.println("finish method executed.");
        System.out.println("The message is: " + result);

    }

}
```

Follow these guidelines when programming the stand-alone Java client that invokes a conversational Web Service. Code snippets of the guidelines are shown in bold in the preceding example.

- Import the `weblogic.wsee.jaxrpc.WLStub` class:

  ```
  import weblogic.wsee.jaxrpc.WLStub;
  ```

- Set the WLStub.Complex property on the JAX-RPC stub of the ConversationalService using the _setProperty method:

  ```
  Stub stub = (Stub)port;
  stub._setProperty(WLStub.COMPLEX,  "true");
  ```

  This property specifies to the Web Services runtime that the client is going to invoke an advanced Web Service, in this case a conversational one. This property is automatically set when invoking a conversational Web Service from another WebLogic Web Service.

- Invoke the start operation of the conversational Web Service to start the conversation:

  ```
        String result = port.start();
  ```

- Optionally invoke the continue methods to continue the conversation:

  ```
  result = port.middle(message );
  ```

- Once the conversation is completed, invoke the finish operation so that the conversational Web Service can free up the resources it used for the current conversation:

  ```
  result = port.finish(message );
  ```

Creating Buffered Web Services

When a buffered operation is invoked by a client, the method operation goes on a JMS queue and WebLogic Server deals with it asynchronously. As with Web Service reliable messaging, if WebLogic Server goes down while the method invocation is still in the queue, it will be dealt with as soon as WebLogic Server is restarted. When a client invokes the buffered Web Service, the client does not wait for a response from the invoke, and the execution of the client can continue.

Creating a Buffered Web Service: Main Steps

The following procedure describes how to create a buffered Web Service and a client Web Service that invokes an operation of the buffered Web Service. The procedure shows how to create the JWS files that implement the two Web Services from scratch. If you want to update existing JWS files, use this procedure as a guide. The procedure also shows how to configure the WebLogic Server instance that hosts the buffered Web Service.

Note: Unless you are also using the asynchronous request-response feature, you do not need to invoke a buffered Web Service from another Web Service, you can also invoke it from a stand-alone Java application.

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 generated buffered Web Service. It is further assumed that you have a similar setup for the WebLogic Server instance that hosts the client Web Service that invokes the buffered Web Service. For more information, see:

- Chapter 3, "Common Web Services Use Cases and Examples"
- Chapter 4, "Iterative Development of WebLogic Web Services"
- Chapter 5, "Programming the JWS File"
- Chapter 9, "Invoking Web Services"

1. Configure the WebLogic Server instance that hosts the buffered Web Service.

   See "Configuring the Host WebLogic Server Instance for the Buffered Web Service" on page 6-39.

2. Create a new JWS file, or update an existing one, that will implement the buffered Web Service.

   See "Programming Guidelines for the Buffered JWS File" on page 6-40.

3. Update the `build.xml` file to include a call to the `jwsc` Ant task to compile the JWS file into a buffered Web Service; for example:

```
<jwsc
    srcdir="src"
    destdir="${service-ear-dir}" >
    <jws
      file="examples/webservices/async_buffered/AsyncBufferedImpl.java"
    />
</jwsc>
```

See “Running the jwsc WebLogic Web Services Ant Task” on page 4-6 for general information about using the `jwsc` task.

4. Recompile your destination JWS file by calling the appropriate target and deploying the Web Service to WebLogic Server. For example:

```
prompt> ant build-mainService deploy-mainService
```

5. Create a new JWS file, or update an existing one, that implements the client Web Service that invokes the buffered Web Service.

   See “Programming the JWS File That Invokes the Buffered Web Service” on page 6-42.

6. Update the `build.xml` file that builds the client Web Service.

   See “Updating the build.xml File for a Client of the Buffered Web Service” on page 6-43.

7. Recompile your client JWS file by calling the appropriate target, then redeploy the Web Service to the client WebLogic Server. For example:

```
prompt> ant build-clientService deploy-clientService
```

Configuring the Host WebLogic Server Instance for the Buffered Web Service

Configuring the WebLogic Server instance on which the buffered Web Service is deployed involves configuring JMS resources, such as JMS servers and modules, that are used internally by the Web Services runtime. The following high-level procedure lists the tasks and then points to the Administration Console online help for details on performing the tasks.

1. Invoke the Administration Console for the domain that contains the WebLogic Server instance that hosts the buffered Web Service in your browser.

   See “Invoking the Administration Console” on page 11-4 for instructions on the URL that invokes the Administration Console.

2. Create a JMS Server. You can use an existing one if you do not want to create a new one.

   See Create JMS servers.

3. Create a JMS module that contains a JMS queue. Target the JMS queue to the JMS server you created in the preceding step.

   If you want the buffered Web Service to use the default Web Services queue, set the JNDI name of the JMS queue to `weblogic.wsee.DefaultQueue`. Otherwise, if you use a different JNDI name, be sure to use the `@BufferQueue` annotation in the JWS file to specify this JNDI name to the reliable Web Service. See "Programming Guidelines for the Buffered JWS File" on page 6-40.

If you are using the buffered Web Service feature in a cluster, you must still create a local queue rather than a distributed queue. In addition, you must explicitly target this queue to each server in the cluster.

See Create JMS modules and Create queues.

Programming Guidelines for the Buffered JWS File

The following example shows a simple JWS file that implements a buffered Web Service; see the explanation after the example for coding guidelines that correspond to the Java code in bold.

```
package examples.webservices.buffered;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.Oneway;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.MessageBuffer;
import weblogic.jws.BufferQueue;

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

@WLHttpTransport(contextPath="buffered",
                 serviceUri="BufferedService",
                 portName="BufferedPort")

// Annotation to specify a specific JMS queue rather than the default

@BufferQueue(name="my.jms.queue")

/**
 * Simple buffered Web Service.
 */

public class BufferedImpl {

  @WebMethod()
  @MessageBuffer(retryCount=10, retryDelay="10 seconds")
  @Oneway()

  public void sayHelloNoReturn(String message) {
    System.out.println("sayHelloNoReturn: " + message);

  }
}
```

Follow these guidelines when programming the JWS file that implements a buffered Web Service. Code snippets of the guidelines are shown in bold in the preceding example.

- Import the JWS annotations used for buffered Web Services:

  ```
  import javax.jws.Oneway;
  ```

  ```
  import weblogic.jws.MessageBuffer;
  import weblogic.jws.BufferQueue;
  ```

  See the following bullets for guidelines on which JWS annotations are required.

- Optionally use the class-level `@BufferQueue` JWS annotation to specify the JNDI name of the JMS queue used internally by WebLogic Server when it processes a buffered invoke; for example:

  ```
  @BufferQueue(name="my.jms.queue")
  ```

  If you do not specify this JWS annotation, then WebLogic Server uses the default Web Services JMS queue (`weblogic.wsee.DefaultQueue`).

  You must create both the default JMS queue and any queues specified with this annotation before you can successfully invoke a buffered operation. See "Configuring the Host WebLogic Server Instance for the Buffered Web Service" on page 6-39 for details.

- Use the `@MessageBuffer` JWS annotation to specify the operations of the Web Service that are buffered. The annotation has two optional attributes:

  – `retryCount`: The number of times WebLogic Server should attempt to deliver the message from the JMS queue to the Web Service implementation (default 3).

  – `retryDelay`: The amount of time that the server should wait in between retries (default 5 minutes).

  For example:

  ```
  @MessageBuffer(retryCount=10, retryDelay="10 seconds")
  ```

  You can use this annotation at the class-level to specify that all operations are buffered, or at the method-level to choose which operations are buffered.

- If you plan on invoking the buffered Web Service operation synchronously (or in other words, *not* using the asynchronous request-response feature), then the implementing method is required to be annotated with the `@Oneway` annotation to specify that the method is one-way. This means that the method cannot return a value, but rather, must explicitly return `void`. For example:

  ```
  @Oneway()
  public void sayHelloNoReturn(String message) {
  ```

Conversely, if the method is *not* annotated with the `@Oneway` annotation, then you must invoke it using the asynchronous request-response feature. If you are unsure how the operation is going to be invoked, consider creating two flavors of the operation: synchronous and asynchronous.

See "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17 and "Using the Asynchronous Features Together" on page 6-44.

Programming the JWS File That Invokes the Buffered Web Service

You can invoke a buffered Web Service from both a stand-alone Java application (if not using asynchronous request-response) and from another Web Service. Unlike other WebLogic Web Services asynchronous features, however, you do not use the `@ServiceClient` JWS annotation in the client Web Service, but rather, you invoke the service as you would any other. For details, see "Invoking a Web Service from Another Web Service" on page 9-11.

The following sample JWS file shows how to invoke the `sayHelloNoReturn` operation of the `BufferedService` Web Service:

```
package examples.webservices.buffered;

import java.rmi.RemoteException;
import javax.xml.rpc.ServiceException;

import javax.jws.WebService;
import javax.jws.WebMethod;

import weblogic.jws.WLHttpTransport;

import examples.webservices.buffered.BufferedPortType;
import examples.webservices.buffered.BufferedService_Impl;
import examples.webservices.buffered.BufferedService;

@WebService(name="BufferedClientPortType",
            serviceName="BufferedClientService",
            targetNamespace="http://examples.org")

@WLHttpTransport(contextPath="bufferedClient",
                 serviceUri="BufferedClientService",
                 portName="BufferedClientPort")

public class BufferedClientImpl {

  @WebMethod()
  public String callBufferedService(String input, String serviceUrl)
        throws RemoteException {
```

```
        try {

        BufferedService service = new BufferedService_Impl(serviceUrl + "?WSDL");
        BufferedPortType port = service.getBufferedPort();

        // Invoke the sayHelloNoReturn() operation of BufferedService

        port.sayHelloNoReturn(input);

        return "Invoke went okay!";

        } catch (ServiceException se) {

             System.out.println("ServiceExcpetion thrown");
             throw new RuntimeException(se);

          }
      }
  }
```

Updating the build.xml File for a Client of the Buffered Web Service

To update a `build.xml` file to generate the JWS file that invokes a buffered Web Service operation, add `taskdefs` and a `build-clientService` targets that look something like the following example. See the description after the example for details.

```
<path id="ws.clientService.class.path">
    <pathelement path="${tempjar-dir}"/>
    <pathelement path="${java.class.path}"/>
</path>

<taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

<taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

<target name="build-clientService">

    <clientgen

wsdl="http://${wls.hostname}:${wls.port}/buffered/BufferedService?WSDL"
      destDir="${tempjar-dir}"
      packageName="examples.webservices.buffered"/>

    <javac
      source="1.5"
      srcdir="${tempjar-dir}"
```

```
        destdir="${tempjar-dir}"
        includes="**/*.java"/>

      <jwsc
         srcdir="src"
         destdir="${clientService-ear-dir}"
         classpathref="ws.clientService.class.path">
         <jws
            file="examples/webservices/buffered/BufferedClientImpl.java"
         />

      </jwsc>

      <copy todir="${clientService-ear-dir}/app-inf/classes">
           <fileset dir="${tempjar-dir}" />
      </copy>

    </target>
```

Use the `taskdef` Ant task to define the full classname of the `jwsc` and `clientgen` Ant tasks.

Before running the `jwsc` Ant task, you must first use `clientgen` to generate and compile the JAX-RPC stubs for the deployed `BufferedService` Web Service; this is because the `BufferedClientImpl` JWS file imports and uses one of the generated classes, and the `jwsc` task will fail if the classes does not already exist. When you execute the `jwsc` Ant task, use the `classpathref` attribute to add to the CLASSPATH the temporary directory into which `clientgen` generated its artifacts.

After `jwsc` has generated all its artifacts into the EAR directory, use the `copy` Ant task to copy the `clientgen`-generated artifacts into the `APP-INF/classes` directory of the EAR so that the `BufferedClientService` Web Service can find them.

Note: The `APP-INF/classes` directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

Using the Asynchronous Features Together

The preceding sections describe how to use the WebLogic Web Service asynchronous features (Web Service reliable messaging, conversations, asynchronous request-response, and buffering) on their own. Typically, however, Web Services use the features together; see "Example of a JWS File That Implements a Reliable Conversational Web Service" on page 6-45 and "Example of Client Web Service That Asynchronously Invokes a Reliable Conversational Web Service" on page 6-46 for examples.

When used together, some restrictions described in the individual feature sections do not apply, and sometimes additional restrictions apply.

- **Asynchronous request-response with Web Service reliable messaging or buffering**—The asynchronous response from the reliable Web Service is also reliable. This means that you must also configure a JMS server, module, and queue on the *source* WebLogic Server instance, in a similar way you configured the destination WebLogic Server instance, to handle the response.

  When you create the JMS queue on the source WebLogic Server instance, you are required to specify a JNDI name of `weblogic.wsee.DefaultQueue`; you can name the queue anything you want.

- **Asynchronous request-response with Web Service reliable messaging or buffering**—The reliable or buffered operation *cannot* be one-way; in other words, you cannot annotate the implementing method with the `@Oneway` annotation.
- **Asynchronous request-response with Web Service reliable messaging**—If you set a property in one of the asynchronous contexts (`AsyncPreCallContext` or `AsyncPostCallContext`), then the property must implement `java.io.Serializable`.
- **Asynchronous request-response with buffering**—You must use the `@ServiceClient` JWS annotation in the client Web Service that invokes the buffered Web Service operation.
- **Conversations with Web Service reliable messaging**—If you set the property `WLStub.CONVERSATIONAL_METHOD_BLOCK_TIMEOUT` on the stub of the client Web Service, the property is ignored because the client does not block.
- **Conversations with Web Service reliable messaging**—At least one method of the reliable conversational Web Service must *not* be marked with the `@Oneway` annotation.
- **Conversations with asynchronous request-response**—Asynchronous responses between a client conversational Web Service and any other Web Service also participate in the conversation. For example, assume `WebServiceA` is conversational, and it invokes `WebServiceB` using asynchronous request-response. Because `WebServiceA` is conversational the asynchronous responses from `WebServiceB` also participates in the same conversation.

Example of a JWS File That Implements a Reliable Conversational Web Service

The following sample JWS file implements a Web Service that is both reliable and conversational:

```
package examples.webservices.async_mega;

import java.io.Serializable;
```

```
import weblogic.jws.WLHttpTransport;
import weblogic.jws.Conversation;
import weblogic.jws.Policy;

import javax.jws.WebService;
import javax.jws.WebMethod;

@WebService(name="AsyncMegaPortType",
            serviceName="AsyncMegaService",
            targetNamespace="http://examples.org/")

@Policy(uri="AsyncReliableConversationPolicy.xml",
        attachToWsdl=true)

@WLHttpTransport(contextPath="asyncMega",
                 serviceUri="AsyncMegaService",
                 portName="AsyncMegaServicePort")

/**
 * Web Service that is both reliable and conversational.
 */

public class AsyncMegaServiceImpl implements Serializable {

  @WebMethod
  @Conversation (Conversation.Phase.START)
  public String start() {
    return "Starting conversation";
  }

  @WebMethod
  @Conversation (Conversation.Phase.CONTINUE)
  public String middle(String message) {
    return "Middle of conversation; the message is: " + message;
  }

  @WebMethod
  @Conversation (Conversation.Phase.FINISH)
  public String finish(String message ) {
    return "End of conversation; the message is: " + message;
  }

}
```

Example of Client Web Service That Asynchronously Invokes a Reliable Conversational Web Service

The following JWS file shows how to implement a client Web Service that reliably invokes the various conversational methods of the Web Service described in “Example of a JWS File That

Implements a Reliable Conversational Web Service” on page 6-45; the client JWS file uses the asynchronous request-response feature as well.

```
package examples.webservices.async_mega;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.ServiceClient;
import weblogic.jws.AsyncResponse;
import weblogic.jws.AsyncFailure;

import javax.jws.WebService;
import javax.jws.WebMethod;

import weblogic.wsee.async.AsyncPreCallContext;
import weblogic.wsee.async.AsyncCallContextFactory;
import weblogic.wsee.async.AsyncPostCallContext;

import examples.webservices.async_mega.AsyncMegaPortType;
import examples.webservices.async_mega.AsyncMegaService;
import examples.webservices.async_mega.AsyncMegaService_Impl;

import java.rmi.RemoteException;

@WebService(name="AsyncMegaClientPortType",
            serviceName="AsyncMegaClientService",
            targetNamespace="http://examples.org/")

@WLHttpTransport(contextPath="asyncMegaClient",
                 serviceUri="AsyncMegaClient",
                 portName="AsyncMegaClientServicePort")

/**
 * Client Web Service that has a conversation with the AsyncMegaService
 * reliably and asynchronously.
 */

public class AsyncMegaClientImpl {

  @ServiceClient(
     wsdlLocation="http://localhost:7001/asyncMega/AsyncMegaService?WSDL",
     serviceName="AsyncMegaService",
     portName="AsyncMegaServicePort")

  private AsyncMegaPortType port;

  @WebMethod
  public void runAsyncReliableConversation(String message) {

    AsyncPreCallContext apc = AsyncCallContextFactory.getAsyncPreCallContext();
    apc.setProperty("message", message);
```

```
    try {
      port.startAsync(apc);
      System.out.println("start method executed.");

      port.middleAsync(apc, message );
      System.out.println("middle method executed.");

      port.finishAsync(apc, message );
      System.out.println("finish method executed.");

    }
    catch (RemoteException e) {
      e.printStackTrace();
    }

  }

  @AsyncResponse(target="port", operation="start")
  public void onStartAsyncResponse(AsyncPostCallContext apc, String message) {
    System.out.println("-------------------");
    System.out.println("Got message " + message );
    System.out.println("-------------------");
  }

  @AsyncResponse(target="port", operation="middle")
  public void onMiddleAsyncResponse(AsyncPostCallContext apc, String message) {
    System.out.println("-------------------");
    System.out.println("Got message " + message );
    System.out.println("-------------------");
  }

  @AsyncResponse(target="port", operation="finish")
  public void onFinishAsyncResponse(AsyncPostCallContext apc, String message) {
    System.out.println("-------------------");
    System.out.println("Got message " + message );
    System.out.println("-------------------");
  }

  @AsyncFailure(target="port", operation="start")
  public void onStartAsyncFailure(AsyncPostCallContext apc, Throwable e) {
    System.out.println("-------------------");
    e.printStackTrace();
    System.out.println("-------------------");
  }

  @AsyncFailure(target="port", operation="middle")
  public void onMiddleAsyncFailure(AsyncPostCallContext apc, Throwable e) {
    System.out.println("-------------------");
    e.printStackTrace();
    System.out.println("-------------------");
  }
```

```
  @AsyncFailure(target="port", operation="finish")
  public void onFinishAsyncFailure(AsyncPostCallContext apc, Throwable e) {
    System.out.println("-------------------");
    e.printStackTrace();
    System.out.println("-------------------");

  }

}
```

Using Reliable Messaging or Asynchronous Request Response With a Proxy Server

Client applications that invoke reliable Web Services or use the asynchronous request-response feature might not invoke the operation directly, but rather, use a proxy server. Reasons for using a proxy include the presence of a firewall or the deployment of the invoked Web Service to a cluster.

In this case, the WebLogic Server instance that hosts the invoked Web Service must be configured with the address and port of the proxy server. If your Web Service is deployed to a cluster, you must configure every server in the cluster.

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 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.

Advanced JWS Programming: JMS Tranpsort and SOAP Message Handlers

The following sections provide information about the following advanced JWS programming topics:

- "Using JMS Transport as the Connection Protocol" on page 7-1
- "Creating and Using SOAP Message Handlers" on page 7-6

Using JMS Transport as the Connection Protocol

Typically, client applications use HTTP/S as the connection protocol when invoking a WebLogic Web Service. You can, however, configure a WebLogic Web Service so that client applications use JMS as the transport instead. You configure transports using either JWS annotations or child elements of the `jwsc` Ant task, as described in later sections.

When a WebLogic Web Service is configured to use 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://`. An example of a JMS endpoint address is as follows:

```
jms://myHost:7001/transports/JMSTransport?URI=JMSTransportQueue
```

The `URI=JMSTransportQueue` section of the URL specifies the JMS queue that has been configured for the JMS transport feature. 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-RPC stubs for the Web Service.

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 add the transports using the appropriate JWS annotations or child elements of `jwsc`.

Caution: Using JMS transport is an added-value WebLogic feature; non-WebLogic client applications, such as a .NET client, may not be able to invoke the Web Service using the JMS port.

Using JMS Transport: Main Steps

The following procedure describes how to specify that your Web Service can be invoked using the JMS transport.

It is assumed that you have already created a basic JWS file that implements a Web Service and that you want to configure the Web Service to be invoked using JMS. 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 targets for running the `jwsc` Ant task and deploying the service. For more information, see Chapter 4, "Iterative Development of WebLogic Web Services," and Chapter 5, "Programming the JWS File."

1. Invoke the Administration Console in your browser, as described in "Invoking the Administration Console" on page 11-4.
2. Using the Administration Console, create and configure the following JMS components, if they do not already exist:
   - JMS Server.

     See Create JMS Servers.
   - JMS Module, targeted to the preceding JMS server.

     See Create JMS Modules.
   - JMS Queue, contained within the preceding JMS module. You can either specify the JNDI name of the JMS queue that WebLogic Web Services listen to by default (`weblogic.wsee.DefaultQueue`) or specify a different name. If you specify a different JNDI name, you later pass this name to the Web Service itself.

     See Create Queues.

   Except for the JNDI name of the JMS queue, you can name the other components anything you want.
3. Add the `@WLJmsTransport` annotation to your JWS file.

   See "Using the @WLJmsTransport JWS Annotation" on page 7-3.

4. Optionally add a `<WLJmsTransport>` child element to the `jwsc` Ant task if you want to override JMS ports from the one you specified in the preceding step.

   See "Using the <WLJmsTransport> Child Element of the jwsc Ant Task" on page 7-5 for details.

5. Rebuild your Web Service by re-running the target in the `build.xml` Ant file that calls the `jwsc` task.

   For example, if the target that calls the `jwsc` Ant task is called `build-service`, then you would run:

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

6. Redeploy your Web Service to WebLogic Server.

See "Invoking a WebLogic Web Service Using JMS Transport" on page 7-6 for information about updating your client application to invoke the Web Service using JMS transport.

Using the @WLJmsTransport JWS 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 `@WLJmsTransport` to specify the details of the invoke. Later, at build-time, you can override the one in the JWS file and add additional JMS transport specifications, by specifying the `<WLJmsTransport>` child element of the `jwsc` Ant task, as described in "Using the <WLJmsTransport> Child Element of the jwsc Ant Task" on page 7-5.

Follow these guidelines when using the `@WLJmsTranport` annotation:

- You can include only *one* `@WLJmsTransport` annotation in a JWS file.
- If you specify the `@WLJmsTransport` annotation, you cannot specify any of the other transport annotations (`@WLHttpTransport` or `@WLHttpsTransport`.)
- Use the `queue` attribute to specify the JNDI name of the JMS queue you configured earlier in the section. If you want to use the default Web Services queue (`weblogic.wsee.DefaultQueue`) then you do not have to specify the `queue` attribute.

The following example shows a simple JWS file that uses the `@WLJmsTransport` annotation, with the relevant code in bold:

```
package examples.webservices.jmstransport;
```

```
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;

import weblogic.jws.WLJmsTransport;

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

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

// WebLogic-specific JWS annotation that specifies the context path and
// service URI used to build the URI of the Web Service is
// "transports/JMSTransport"

@WLJmsTransport(contextPath="transports", serviceUri="JMSTransport",
            queue="JMSTransportQueue", portName="JMSTransportServicePort")

/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHello
 *
 * @author Copyright (c) 2005 by BEA Systems.  All rights reserved.
 */

public class JMSTransportImpl {

  @WebMethod()
  public String sayHello(String message) {
    System.out.println("sayHello:" + message);
    return "Here is the message: '" + message + "'";
  }
}
```

Using the <WLJmsTransport> Child Element of the jwsc Ant Task

You can also specify the JMS transport at build-time by using the `<WLJmsTransport>` child element of the `<jws>` element of the `jwsc` Ant task. Reasons for specifying the transport at build-time include:

- You need to override the attribute values specified in the JWS file.
- The JWS file specifies a different transport, and at build-time you decide that JMS should be the transport.
- The JWS file does not include a `@WLXXXTransport` annotation; thus by default the HTTP transport is used, but at build-time you decide you want to clients to use the JMS transport to invoke the Web Service.

If you specify a transport to the `jwsc` Ant task, it takes precedence over any transport annotation in the JWS file.

The following example shows how to specify a transport to the `jwsc` Ant task:

```
<target name="build-service">

  <jwsc
    srcdir="src"
    destdir="${ear-dir}">
    <jws file="examples/webservices/jmstransport/JMSTransportImpl.java">

      <WLJmsTransport
              contextPath="transports"
              serviceUri="JMSTransport"
              portName="JMSTransportServicePort"
             queue="JMSTransportQueue"/>

    </jws>

  </jwsc>

</target>
```

The preceding example shows how to specify the same values for the URL and JMS queue as were specified in the JWS file shown in "Using the @WLJmsTransport JWS Annotation" on page 7-3.

For more information about using the `jwsc` Ant task, see "jwsc" on page A-13.

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; the only difference is that you must ensure that the JMS queue (specified by the `@WLJmsTransport` annotation or `<WLJmsTransport>` child element of the `jwsc` Ant task) and other JMS objects have already been created. See "Using JMS Transport: Main Steps" on page 7-2 for more information.

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-RPC stubs for the Web Service. For example, the URL for the WSDL of the Web Service shown in this section would be:

```
http://host:port/transports/JMSTransport?WSDL
```

However, because the endpoint address in the WSDL of the deployed Web Service uses `jms://` instead of `http://`, and the address includes the qualifier `?URI=`*`JMS_QUEUE`*, the `clientgen` Ant task automatically creates the stubs needed to use the JMS transport when invoking the Web Service, and your client application need not do anything different than normal. An example of a JMS endpoint address is as follows:

```
jms://host:port/transports/JMSTransport?URI=JMSTransportQueue
```

For general information about invoking a Web Service, see Chapter 9, "Invoking Web Services."

Creating and Using SOAP Message Handlers

Some Web Services need access to the SOAP message, for which you can create 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 handlers in both the Web Service itself and the client applications that invoke the Web Service.

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.

The following table lists the standard JWS annotations that you can use in your JWS file to specify that a Web Service has a handler chain configured; later sections discuss how to use the annotations in more detail. For additional information, see the *Web Services MetaData for the Java Platform* (JSR-181) specification at http://www.jcp.org/en/jsr/detail?id=181.

Table 7-1 JWS Annotations Used To Configure SOAP Message Handler Chains

JWS Annotation	Description
`javax.jws.HandlerChain`	Associates the Web Service with an externally defined handler chain. Use this annotation (rather than `@SOAPMessageHandlers`) when multiple Web Services need to share the same handler configuration, or if the handler chain consists of handlers for multiple transports.
`javax.jws.soap.SOAPMessageHandlers`	Specifies a list of SOAP handlers that run before and after the invocation of each Web Service operation. Use this annotation (rather than `@HanderChain`) if embedding handler configuration information in the JWS file itself is preferred, rather than having an external configuration file. The `@SOAPMessageHandler` annotation is an array of `@SOAPMessageHandlers`. The handlers are executed in the order they are listed in this array.
`javax.jws.soap.SOAPMessageHandler`	Specifies a single SOAP message handler in the `@SOAPMessageHandlers` array.

The following table describes the main classes and interfaces of the `javax.xml.rpc.handler` API, some of which you use when creating the handler itself. These APIs are discussed in detail in a later section. For additional information about these APIs, see the JAX-RPC 1.1 specification at http://java.sun.com/xml/jaxrpc/index.jsp.

Table 7-2 JAX-RPC Handler Interfaces and Classes

javax.xml.rpc.handler Classes and Interfaces	Description
`Handler`	Main interface that is implemented when creating a handler. Contains methods to handle the SOAP request, response, and faults.
`GenericHandler`	Abstract class that implements the `Handler` interface. User should extend this class when creating a handler, rather than implement `Handler` directly. The `GenericHandler` class is a convenience abstract class that makes writing handlers easy. This class provides default implementations of the lifecycle methods init and destroy and also different handle methods. A handler developer should only override methods that it needs to specialize as part of the derived handler implementation class.
`HandlerChain`	Interface that represents a list of handlers. An implementation class for the `HandlerChain` interface abstracts the policy and mechanism for the invocation of the registered handlers.
`HandlerRegistry`	Interface that provides support for the programmatic configuration of handlers in a HandlerRegistry.
`HandlerInfo`	Class that contains information about the handler in a handler chain. A `HandlerInfo` instance is passed in the `Handler.init` method to initialize a `Handler` instance.
`MessageContext`	Abstracts the message context processed by the handler. The `MessageContext` properties allow the handlers in a handler chain to share processing state.
`soap.SOAPMessageContext`	Sub-interface of the MessageContext interface used to get at or update the SOAP message.
`javax.xml.soap.SOAPMessage`	Object that contains the actual request or response SOAP message, including its header, body, and attachment.

Adding SOAP Message Handlers to a Web Service: 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 already 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 4, "Iterative Development of WebLogic Web Services," and Chapter 5, "Programming the JWS File."

1. Design the handlers and handler chains.

   See "Designing the SOAP Message Handlers and Handler Chains" on page 7-9.

2. For each handler in the handler chain, create a Java class that extends the `javax.xml.rpc.handler.GenericHandler` abstract class.

   See "Creating the GenericHandler Class" on page 7-12.

3. Update your JWS file, adding annotations to configure the SOAP message handlers.

   See "Configuring Handlers in the JWS File" on page 7-20.

4. If you are using the `@HandlerChain` standard annotation in your JWS file, create the handler chain configuration file.

   See "Creating the Handler Chain Configuration File" on page 7-24.

5. Compile all handler classes in the handler chain and rebuild your Web Service.

   See "Compiling and Rebuilding the Web Service" on page 7-25.

For information about creating client-side SOAP message handlers and handler chains, see "Creating and Using Client-Side SOAP Message Handlers" on page 9-17.

Designing the SOAP Message Handlers and Handler Chains

When designing your SOAP message handlers and handler chains, you must decide:

- The number of handlers needed to perform all the work
- The sequence of execution

Each handler in a handler chain has one method for handling the request SOAP message and another method for handling the response SOAP message. An ordered group of handlers is referred to as a *handler chain*. You specify that a Web Service has a handler chain attached to it with one of two JWS annotations: `@HandlerChain` or `@SOAPMessageHandler`. When to use which is discussed in a later section.

When invoking a Web Service, WebLogic Server executes handlers as follows:

1. The `handleRequest()` methods of the handlers in the handler chain are all executed in the order specified by the JWS annotation. Any of these `handleRequest()` methods might change the SOAP message request.
2. When the `handleRequest()` method of 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 `handleResponse()` methods of the handlers in the handler chain are executed in the *reverse* order specified in by the JWS annotation. Any of these `handleResponse()` methods might change the SOAP message response.
4. When the `handleResponse()` method of 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.

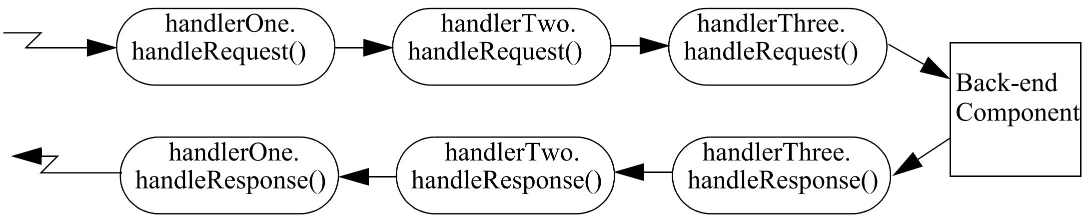
For example, assume that you are going to use the `@HandlerChain` JWS annotation in your JWS file to specify an external configuration file, and the configuration file defines a handler chain called `SimpleChain` that contains three handlers, as shown in the following sample:

```
<jwshc:handler-config xmlns:jwshc="http://www.bea.com/xml/ns/jws"
   xmlns:soap1="http://HandlerInfo.org/Server1"
   xmlns:soap2="http://HandlerInfo.org/Server2"
   xmlns="http://java.sun.com/xml/ns/j2ee" >

   <jwshc:handler-chain>

     <jwshc:handler-chain-name>SimpleChain</jwshc:handler-chain-name>

     <jwshc:handler>
       <handler-name>handlerOne</handler-name>

<handler-class>examples.webservices.soap_handlers.global_handler.ServerHandler
1</handler-class>
     </jwshc:handler>
```

```
      <jwshc:handler>
        <handler-name>handlerTwo</handler-name>

<handler-class>examples.webservices.soap_handlers.global_handler.ServerHandler
2</handler-class>
      </jwshc:handler>

      <jwshc:handler>
        <handler-name>handlerThree</handler-name>

<handler-class>examples.webservices.soap_handlers.global_handler.ServerHandler
3</handler-class>
      </jwshc:handler>

   </jwshc:handler-chain>

</jwshc:handler-config>
```

The following graphic shows the order in which WebLogic Server executes the `handleRequest()` and `handleResponse()` methods of each handler.

Figure 7-1 Order of Execution of Handler Methods0



Each SOAP message handler has a separate method to process the request and response SOAP message because the same type of processing typically must happen for the the inbound and outbound message. For example, you might design an Encryption handler whose `handleRequest()` method decrypts secure data in the SOAP request and `handleResponse()` method encrypts the SOAP response.

You can, however, design a handler that process 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.

Creating the GenericHandler Class

Your SOAP message handler class should extend the `javax.rpc.xml.handler.GenericHandler` abstract class, which itself implements the `javax.rpc.xml.handler.Handler` interface.

The `GenericHandler` class is a convenience abstract class that makes writing handlers easy. This class provides default implementations of the lifecycle methods `init()` and `destroy()` and the various `handleXXX()` methods of the `Handler` interface. When you write your handler class, only override those methods that you need to customize as part of your `Handler` implementation class.

In particular, the `Handler` interface contains the following methods that you can implement in your handler class that extends `GenericHandler`:

- `init()`

  See "Implementing the Handler.init() Method" on page 7-14.
- `destroy()`

  See "Implementing the Handler.destroy() Method" on page 7-15.
- `getHeaders()`

  See "Implementing the Handler.getHeaders() Method" on page 7-15.
- `handleRequest()`

  See "Implementing the Handler.handleRequest() Method" on page 7-15.
- `handleResponse()`

  See "Implementing the Handler.handleResponse() Method" on page 7-17.
- `handleFault()`

  See "Implementing the Handler.handleFault() Method" on page 7-18.

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 For details, see "Directly Manipulating the SOAP Request and Response Message Using SAAJ" on page 7-19.

The following example demonstrates a simple SOAP message handler that prints out the SOAP request and response messages to the WebLogic Server log file:

```
package examples.webservices.soap_handlers.global_handler;
```

```
import javax.xml.namespace.QName;
import javax.xml.rpc.handler.HandlerInfo;
import javax.xml.rpc.handler.GenericHandler;
import javax.xml.rpc.handler.MessageContext;
import javax.xml.rpc.handler.soap.SOAPMessageContext;
import javax.xml.rpc.JAXRPCException;

import weblogic.logging.NonCatalogLogger;

/**
 * This class implements a handler in the handler chain, used to access the SOAP
 * request and response message.
 * <p>
 * This class extends the <code>javax.xml.rpc.handler.GenericHandler</code>
 * abstract classs and simply prints the SOAP request and response messages to
 * the server log file before the messages are processed by the backend
 * Java class that implements the Web Service itself.
 */

public class ServerHandler1 extends GenericHandler {

  private NonCatalogLogger log;

  private HandlerInfo handlerInfo;

  /**
   *  Initializes the instance of the handler.  Creates a nonCatalogLogger to
   *  log messages to.
   */

  public void init(HandlerInfo hi) {

    log = new NonCatalogLogger("WebService-LogHandler");
    handlerInfo = hi;

  }

  /**
   * Specifies that the SOAP request message be logged to a log file before the
   * message is sent to the Java class that implements the Web Service.
   */

  public boolean handleRequest(MessageContext context) {

   SOAPMessageContext messageContext = (SOAPMessageContext) context;

   System.out.println("** Request: "+messageContext.getMessage().toString());
   log.info(messageContext.getMessage().toString());
   return true;

  }
```

```
  /**
   * Specifies that the SOAP response message be logged to a log file before the
   * message is sent back to the client application that invoked the Web
   * service.
   */

  public boolean handleResponse(MessageContext context) {

    SOAPMessageContext messageContext = (SOAPMessageContext) context;

    System.out.println("** Response: "+messageContext.getMessage().toString());
    log.info(messageContext.getMessage().toString());
    return true;

  }

  /**
   * Specifies that a message be logged to the log file if a SOAP fault is
   * thrown by the Handler instance.
   */

  public boolean handleFault(MessageContext context) {

   SOAPMessageContext messageContext = (SOAPMessageContext) context;

   System.out.println("** Fault: "+messageContext.getMessage().toString());
   log.info(messageContext.getMessage().toString());
       return true;

  }

  public QName[] getHeaders() {

    return handlerInfo.getHeaders();

  }

}
```

Implementing the Handler.init() Method

The `Handler.init()` method is called to create an instance of a `Handler` object and to enable the instance to initialize itself. Its signature is:

```
public void init(HandlerInfo config) throws JAXRPCException {}
```

The `HandlerInfo` object contains information about the SOAP message handler, in particular the initialization parameters. Use the `HandlerInfo.getHandlerConfig()` method to get the parameters; the method returns a `java.util.Map` object that contains name-value pairs.

Implement the `init()` method if you need to process the initialization parameters or if you have other initialization tasks to perform.

Sample uses of initialization parameters are to turn debugging on or off, specify the name of a log file to which to write messages or errors, and so on.

Implementing the Handler.destroy() Method

The `Handler.destroy()` method is called to destroy an instance of a `Handler` object. Its signature is:

```
public void destroy() throws JAXRPCException {}
```

Implement the `destroy()` method to release any resources acquired throughout the handler's lifecycle.

Implementing the Handler.getHeaders() Method

The `Handler.getHeaders()` method gets the header blocks that can be processed by this `Handler` instance. Its signature is:

```
public QName[] getHeaders() {}
```

Implementing the Handler.handleRequest() Method

The `Handler.handleRequest()` method is called to intercept a SOAP message request before it is processed by the back-end component. Its signature is:

```
public boolean handleRequest(MessageContext mc)
       throws JAXRPCException,SOAPFaultException  {}
```

Implement this method to perform such tasks as decrypting data in the SOAP message before it is processed by the back-end component, and so on.

The `MessageContext` object abstracts the message context processed by the SOAP message handler. The `MessageContext` properties allow the handlers in a handler chain to share processing state.

Use the `SOAPMessageContext` sub-interface of `MessageContext` to get at or update the contents of the SOAP message request. The SOAP message request itself is stored in a `javax.xml.soap.SOAPMessage` object. For detailed information on this object, see "Directly Manipulating the SOAP Request and Response Message Using SAAJ" on page 7-19.

The `SOAPMessageContext` class defines two methods for processing the SOAP request:

- `SOAPMessageContext.getMessage()` returns a `javax.xml.soap.SOAPMessage` object that contains the SOAP message request.
- `SOAPMessageContext.setMessage(javax.xml.soap.SOAPMessage)` updates the SOAP message request after you have made changes to it.

After you code all the processing of the SOAP request, 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 either the next `<handler>` subelement of the `<handler-chain>` element in the configuration file specified by the `@HandlerChain` annotation, or the next `@SOAPMessageHandler` in the array specified by the `@SOAPMessageHandlers` annotation. If there are no more handlers in the chain, the method either invokes the back-end component, passing it the final SOAP message request, or invokes the `handleResponse()` method of the last handler, depending on how you have configured your Web Service.

- 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. For example, assume that a handler chain consists of two handlers: handlerA and handlerB, where the `handleRequest()` method of handlerA is invoked before that of handlerB. If processing is blocked in handlerA (and thus the `handleRequest()` method of handlerB is *not* invoked), the handler response chain starts at handlerA and the `handleRequest()` method of handlerB is not invoked either.

- Throw the `javax.xml.rpc.soap.SOAPFaultException` to indicate a SOAP fault.

  If the `handleRequest()` method throws a `SOAPFaultException`, WebLogic Server catches the exception, terminates further processing of the handler request chain, and invokes the `handleFault()` method of this handler.

- Throw a `JAXRPCException` for any handler-specific runtime errors.

  If the `handleRequest()` method throws a `JAXRPCException`, 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.

Implementing the Handler.handleResponse() Method

The `Handler.handleResponse()` method is called to intercept a SOAP message response after it has been processed by the back-end component, but before it is sent back to the client application that invoked the Web Service. Its signature is:

```
public boolean handleResponse(MessageContext mc) throws JAXRPCException {}
```

Implement this method to perform such tasks as encrypting data in the SOAP message before it is sent back to the client application, to further process returned values, and so on.

The `MessageContext` object abstracts the message context processed by the SOAP message handler. The `MessageContext` properties allow the handlers in a handler chain to share processing state.

Use the `SOAPMessageContext` sub-interface of `MessageContext` to get at or update the contents of the SOAP message response. The SOAP message response itself is stored in a `javax.xml.soap.SOAPMessage` object. See "Directly Manipulating the SOAP Request and Response Message Using SAAJ" on page 7-19.

The `SOAPMessageContext` class defines two methods for processing the SOAP response:

- `SOAPMessageContext.getMessage()`: returns a `javax.xml.soap.SOAPMessage` object that contains the SOAP message response.
- `SOAPMessageContext.setMessage(javax.xml.soap.SOAPMessage)`: updates the SOAP message response after you have made changes to it.

After you code all the processing of the SOAP response, code one of the following scenarios:

- Invoke the next handler on the handler response chain by returning `true`.

  The next response on the handler chain is specified as either the preceding `<handler>` subelement of the `<handler-chain>` element in the configuration file specified by the `@HandlerChain` annotation, or the preceding `@SOAPMessageHandler` in the array specified by the `@SOAPMessageHandlers` annotation. (Remember that responses on the handler chain execute in the *reverse* order that they are specified in the JWS file. See "Designing the SOAP Message Handlers and Handler Chains" on page 7-9 for more information.)

  If there are no more handlers in the chain, the method sends the final SOAP message response to the client application that invoked the Web Service.

- Block processing of the handler response chain by returning `false`.

Blocking the handler response chain processing implies that the remaining handlers on the response chain do not get executed for this invoke of the Web Service and the current SOAP message is sent back to the client application.

- Throw a `JAXRPCException` for any handler specific runtime errors.

  If the `handleRequest()` method throws a `JAXRPCException`, WebLogic Server catches the exception, terminates further processing of the handler request chain, logs the exception to the WebLogic Server logfile, and invokes the `handleFault()` method of this handler.

Implementing the Handler.handleFault() Method

The `Handler.handleFault()` method processes the SOAP faults based on the SOAP message processing model. Its signature is:

```
public boolean handleFault(MessageContext mc) throws JAXRPCException  {}
```

Implement this method to handle processing of any SOAP faults generated by the `handleResponse()` and `handleRequest()` methods, as well as faults generated by the back-end component.

The `MessageContext` object abstracts the message context processed by the SOAP message handler. The `MessageContext` properties allow the handlers in a handler chain to share processing state.

Use the `SOAPMessageContext` sub-interface of `MessageContext` to get at or update the contents of the SOAP message. The SOAP message itself is stored in a `javax.xml.soap.SOAPMessage` object. See "Directly Manipulating the SOAP Request and Response Message Using SAAJ" on page 7-19.

The `SOAPMessageContext` class defines the following two methods for processing the SOAP message:

- `SOAPMessageContext.getMessage()`: returns a `javax.xml.soap.SOAPMessage` object that contains the SOAP message.
- `SOAPMessageContext.setMessage(javax.xml.soap.SOAPMessage)`: updates the SOAP message after you have made changes to it.

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`.

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. 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. For more information on SAAJ, go to http://java.sun.com/xml/saaj/index.html.

The SOAPPart Object

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:

```
SOAPMessage soapMessage =  messageContext.getMessage();
SOAPPart soapPart = soapMessage.getSOAPPart();
SOAPEnvelope soapEnvelope = soapPart.getEnvelope();
SOAPBody soapBody = soapEnvelope.getBody();
SOAPHeader soapHeader = soapEnvelope.getHeader();
```

The AttachmentPart Object

The `javax.xml.soap.AttachmentPart` object 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.

Caution: If you are going to access a `java.awt.Image` attachment from your SOAP message handler, see "Manipulating Image Attachments in a SOAP Message Handler" on page 7-20 for important information.

Use the following methods of the `SOAPMessage` class to manipulate the attachments:

- `countAttachments()`: returns the number of attachments in this SOAP message.
- `getAttachments()`: retrieves all the attachments (as `AttachmentPart` objects) into an `Iterator` object.
- `createAttachmentPart()`: create an `AttachmentPart` object from another type of `Object`.

- `addAttachmentPart()`: adds an `AttachmentPart` object, after it has been created, to the `SOAPMessage`.

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-RPC stubs 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.

Configuring Handlers in the JWS File

There are two standard annotations you can use in your JWS file to configure a handler chain for a Web Service: `@javax.jws.HandlerChain` and `@javax.jws.soap.SOAPMessageHandlers`.

@javax.jws.HandlerChain

When you use the `@javax.jws.HandlerChain` annotation (also called `@HandlerChain` in this chapter for simplicity) you 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.

Use the `@HandlerChain` annotation, rather than the `@SOAPMessageHandlers` annotation, in your JWS file if one or more of the following conditions apply:

- You want multiple Web Services to share the same configuration.
- Your handler chain includes handlers for multiple transports.
- You want to be able to change the handler chain configuration for a Web Service without recompiling the JWS file that implements it.

The following JWS file shows an example of using the `@HandlerChain` annotation; the relevant Java code is shown in bold:

```
package examples.webservices.soap_handlers.global_handler;

import java.io.Serializable;

import javax.jws.HandlerChain;
import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.jws.soap.SOAPBinding;

import weblogic.jws.WLHttpTransport;

@WebService(serviceName="HandlerChainService",
            name="HandlerChainPortType")

// Standard JWS annotation that specifies that the handler chain called
// "SimpleChain", configured in the HandlerConfig.xml file, should fire
// each time an operation of the Web Service is invoked.

@HandlerChain(file="HandlerConfig.xml", name="SimpleChain")

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

@WLHttpTransport(contextPath="HandlerChain", serviceUri="HandlerChain",
                 portName="HandlerChainServicePort")

/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHello.  The Web Service also
 * has a handler chain associated with it, as specified by the
 * @HandlerChain annotation.
 * <p>
 * @author Copyright (c) 2005 by BEA Systems, Inc. All Rights Reserved.
 */

public class HandlerChainImpl  {

   public String sayHello(String input) {
     weblogic.utils.Debug.say( "in backend component. input:" +input );
     return "'" + input + "' to you too!";
   }

}
```

Before you use the `@HandlerChain` annotation, you must import it into your JWS file, as shown in the preceding example.

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.

Use the `name` attribute to specify the name of the handler chain in the configuration file that you want to associate with the Web Service. The value of this attribute corresponds to the `name` attribute of the `<handler-chain>` element in the configuration file.

Warning: It is an error to specify more than one `@HandlerChain` annotation in a single JWS file. It is also an error to combine the `@HandlerChain` annotation with the `@SOAPMessageHandlers` annotation.

For details about creating the external configuration file, see "Creating the Handler Chain Configuration File" on page 7-24.

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.

@javax.jws.soap.SOAPMessageHandlers

When you use the `@javax.jws.soap.SOAPMessageHandlers` (also called `@SOAPMessageHandlers` in this section for simplicity) annotation, you specify, within the JWS file itself, an array of SOAP message handlers (specified with the `@SOAPMessageHandler` annotation) that execute before and after the operations of a Web Service. The `@SOAPMessageHandler` annotation includes attributes to specify the class name of the handler, the initialization parameters, list of SOAP headers processed by the handler, and so on. Because you specify the list of handlers within the JWS file itself, the configuration of the handler chain is embedded within the Web Service.

Use the `@SOAPMessageHandlers` annotation if one or more of the following conditions apply:

- You prefer to embed the configuration of the handler chain inside the Web Service itself, rather than specify the configuration in an external file.
- Your handler chain includes only SOAP handlers and none for any other transport.
- You prefer to recompile the JWS file each time you change the handler chain configuration.

The following JWS file shows a simple example of using the `@SOAPMessageHandlers` annotation; the relevant Java code is shown in bold:

```
package examples.webservices.soap_handlers.simple;

import java.io.Serializable;
```

```
import javax.jws.soap.SOAPMessageHandlers;
import javax.jws.soap.SOAPMessageHandler;
import javax.jws.soap.SOAPBinding;
import javax.jws.WebService;
import javax.jws.WebMethod;

import weblogic.jws.WLHttpTransport;

@WebService(name="SimpleChainPortType",
            serviceName="SimpleChainService")

// Standard JWS annotation that specifies a list of SOAP message handlers
// that exeucte before and after an invocation of all operations in the
// Web Serice.

@SOAPMessageHandlers ( {
        @SOAPMessageHandler (

className="examples.webservices.soap_handlers.simple.ServerHandler1"),
        @SOAPMessageHandler (

className="examples.webservices.soap_handlers.simple.ServerHandler2")
        } )

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

@WLHttpTransport(contextPath="SimpleChain", serviceUri="SimpleChain",
                 portName="SimpleChainServicePort")

/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHello.  The Web Service also
 * has a handler chain associated with it, as specified by the
 * @SOAPMessageHandler/s annotations.
 * <p>
 * @author Copyright (c) 2005 by BEA Systems, Inc. All Rights Reserved.
 */

public class SimpleChainImpl  {

   // by default all public methods are exposed as operations

   public String sayHello(String input)  {
     weblogic.utils.Debug.say( "in backend component. input:" +input );
     return "'" + input + "' to you too!";
   }
}
```

Before you use the `@SOAPMessageHandlers` and `@SOAPMessageHandler` annotations, you must import them into your JWS file, as shown in the preceding example. Note that these annotations are in the `javax.jws.soap` package.

The order in which you list the handlers (using the `@SOAPMessageHandler` annotation) in the `@SOAPMessageHandlers` array specifies the order in which the handlers execute: in forward order before the operation, and in reverse order after the operation. The preceding example configures two handlers in the handler chain, whose class names are `examples.webservices.soap_handlers.simple.ServerHandler1` and `examples.webservices.soap_handlers.simple.ServerHandler2`.

Use the `initParams` attribute of `@SOAPMessageHandler` to specify an array of initialization parameters expected by a particular handler. Use the `@InitParam` standard JWS annotation to specify the name/value pairs, as shown in the following example:

```
@SOAPMessageHandler(
  className =
"examples.webservices.soap_handlers.simple.ServerHandler1",
  initParams = { @InitParam(name="logCategory", value="MyService")}
)
```

The `@SOAPMessageHandler` annotation also includes the `roles` attribute for listing the SOAP roles implemented by the handler, and the `headers` attribute for listing the SOAP headers processed by the handler.

Warning: It is an error to combine the `@SOAPMessageHandlers` annotation with the `@HandlerChain` annotation.

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.

Creating the Handler Chain Configuration File

If you decide to use the `@HandlerChain` annotation in your JWS file to associate a handler chain with a Web Service, you must create 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. Finally, if you include handlers in your handler chain that use a non-SOAP transport, then you are required to use the `@HandlerChain` annotation rather than the `@SOAPMessageHandler` annotation.

The configuration file uses XML to list one or more handler chains, as shown in the following simple example:

```
<jwshc:handler-config xmlns:jwshc="http://www.bea.com/xml/ns/jws"
   xmlns:soap1="http://HandlerInfo.org/Server1"
   xmlns:soap2="http://HandlerInfo.org/Server2"
   xmlns="http://java.sun.com/xml/ns/j2ee" >
   <jwshc:handler-chain>
     <jwshc:handler-chain-name>SimpleChain</jwshc:handler-chain-name>
     <jwshc:handler>
       <handler-name>handler1</handler-name>

<handler-class>examples.webservices.soap_handlers.global_handler.ServerHandler
1</handler-class>
     </jwshc:handler>
     <jwshc:handler>
       <handler-name>handler2</handler-name>

<handler-class>examples.webservices.soap_handlers.global_handler.ServerHandler
2</handler-class>
     </jwshc:handler>
   </jwshc:handler-chain>
</jwshc:handler-config>
```

In the example, the handler chain called `SimpleChain` contains two handlers: `handler1` and `handler2`, 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>`, `<soap-role>`, and `<soap-header>` child elements of the `<handler>` element to specify the handler initialization parameters, SOAP roles implemented by the handler, and SOAP headers processed by the handler, respectively.

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.

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 Chapter 4, "Iterative Development of WebLogic 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 either the `@HandlerChain` or `@SOAPMessageHandlers` 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` or `@SOAPMessageHandler(s)` annotations 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.

Data Types and Data Binding

The following sections provide information about supported data types (both built-in and user-defined) and data binding:

- "Overview of Data Types and Data Binding" on page 8-1
- "Supported Built-In Data Types" on page 8-2
- "Supported User-Defined Data Types" on page 8-6

Overview of Data Types and Data Binding

As in previous releases, WebLogic Web Services support a full set of built-in XML Schema, Java, and SOAP types, as specified by the JAX-RPC 1.1 specification, 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, including `com.bea.xml.XMLBeans`, 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 conversion of data between its XML and Java representations is called *data binding*.

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.

If, however, you use 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 `wsdl2service` Ant tasks that can generate the data binding artifacts for most user-defined data types. See "Supported User-Defined Data Types" on page 8-6 for a list of supported XML and Java data types.

XML-to-Java Mapping for Built-In Data Types

The following table lists the supported XML Schema data types (target namespace `http://www.w3.org/2001/XMLSchema`) and their corresponding Java data types.

For a list of the supported user-defined XML data types, see "Java-to-XML Mapping for Built-In Data Types" on page 8-4.

Table 8-1 Mapping XML Schema Data Types to Java Data Types

XML Schema Data Type	Equivalent Java Data Type (lower case indicates a primitive data type)
boolean	boolean
byte	byte
short	short
int	int
long	long
float	float
double	double
integer	java.math.BigInteger

Table 8-1 Mapping XML Schema Data Types to Java Data Types

XML Schema Data Type	Equivalent Java Data Type (lower case indicates a primitive data type)
decimal	java.math.BigDecimal
string	java.lang.String
dateTime	java.util.Calendar
base64Binary	byte[]
hexBinary	byte[]
duration	java.lang.String
time	java.util.Calendar
date	java.util.Calendar
gYearMonth	java.lang.String
gYear	java.lang.String
gMonthDay	java.lang.String
gDay	java.lang.String
gMonth	java.lang.String
anyURI	java.net.URI
NOTATION	java.lang.String
token	java.lang.String
normalizedString	java.lang.String
language	java.lang.String
Name	java.lang.String
NMTOKEN	java.lang.String
NCName	java.lang.String
NMTOKENS	java.lang.String[]

Table 8-1 Mapping XML Schema Data Types to Java Data Types

XML Schema Data Type	Equivalent Java Data Type (lower case indicates a primitive data type)
ID	java.lang.String
IDREF	java.lang.String
ENTITY	java.lang.String
IDREFS	java.lang.String[]
ENTITIES	java.lang.String[]
nonPositiveInteger	java.math.BigInteger
nonNegativeInteger	java.math.BigInteger
negativeInteger	java.math.BigInteger
unsignedLong	java.math.BigInteger
positiveInteger	java.math.BigInteger
unsignedInt	long
unsignedShort	int
unsignedByte	short
Qname	javax.xml.namespace.QName

Java-to-XML Mapping for Built-In Data Types

For a list of the supported user-defined Java data types, see "Supported Java User-Defined Data Types" on page 8-8.

Table 8-2 Mapping Java Data Types to XML Schema Data Types

Java Data Type (lower case indicates a primitive data type)	Equivalent XML Schema Data Type
int	int
short	short
long	long
float	float
double	double
byte	byte
boolean	boolean
char	string (with facet of length=1)
java.lang.Integer	int
java.lang.Short	short
java.lang.Long	long
java.lang.Float	float
java.lang.Double	double
java.lang.Byte	byte
java.lang.Boolean	boolean
java.lang.Character	string (with facet of length=1)
java.lang.String	string
java.math.BigInteger	integer
java.math.BigDecimal	decimal
java.util.Calendar	dateTime
java.util.Date	dateTime

Table 8-2 Mapping Java Data Types to XML Schema Data Types

Java Data Type (lower case indicates a primitive data type)	Equivalent XML Schema Data Type
byte[]	base64Binary
javax.xml.namespace.QName	Qname
java.net.URI	anyURI

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 `wsdl2service` Ant tasks can generate data binding artifacts, such as the corresponding Java or XML representation, the JAX-RPC type mapping file, and so on.

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 "Supported Built-In Data Types" on page 8-2, then you must create the user-defined data type artifacts manually.

Supported XML User-Defined Data Types

The following table lists the XML Schema data types supported by the `jwsc` and `wsdl2service` Ant tasks and their equivalent Java data type or mapping mechanism.

For details and examples of the data types, see the JAX-RPC specification.

Table 8-3 Supported User-Defined XML Schema Data Types

XML Schema Data Type	Equivalent Java Data Type or Mapping Mechanism
Enumeration	Typesafe enumeration pattern. For details, see Section 4.2.4 of the JAX-RPC specification.
`<xsd:complexType>` with elements of both simple and complex types.	JavaBean
`<xsd:complexType>` with simple content.	JavaBean
`<xsd:attribute>` in `<xsd:complexType>`	Property of a JavaBean

Table 8-3 Supported User-Defined XML Schema Data Types

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

Supported Java User-Defined Data Types

The following table lists the Java user-defined data types supported by the `jwsc` and `sdl2service` Ant tasks and their equivalent XML Schema data type.

Table 8-4 Supported User-Defined Java Data Types

Java Data Type	Equivalent XML Schema Data Type
JavaBean whose properties are any supported data type.	`<xsd:complexType>` whose content model is a `<xsd:sequence>` of elements corresponding to JavaBean properties.
Array of any supported data type (when used as a JavaBean property)	An element in a `<xsd:complexType>` with the `maxOccurs` attribute set to `unbounded`.
java.lang.Object **Note:** The data type of the runtime object must be a known type.	<xsd:anyType>

Note: The following user-defined Java data types, used as parameters or return values of a WebLogic Web Service in Version 8.1, are no longer supported:

- `java.util.List` (when used as a JavaBean property)
- `java.util.ArrayList` (when used as a JavaBean property)
- `java.util.LinkedList` (when used as a JavaBean property)
- `java.util.Vector` (when used as a JavaBean property)
- `java.util.Stack` (when used as a JavaBean property)
- `java.util.Collection` (when used as a JavaBean property)
- `java.util.Set` (when used as a JavaBean property)
- `java.util.HashSet` (when used as a JavaBean property)
- `java.util.SortedSet` (when used as a JavaBean property)
- `java.util.TreeSet` (when used as a JavaBean property)
- JAX-RPC-style enumeration class

- JAX-RPC-style enumeration class

CHAPTER 9

Invoking Web Services

The following sections describe how to invoke WebLogic Web Services:

- "Overview of Invoking Web Services" on page 9-1
- "Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4
- "Invoking a Web Service from Another Web Service" on page 9-11
- "Creating and Using Client-Side SOAP Message Handlers" on page 9-17
- "Using a Client-Side Security WS-Policy File" on page 9-22

Overview of Invoking Web Services

Invoking a Web Service refers to the actions that a client application performs to use the Web Service. Client applications that invoke Web Services can be written using any technology: Java, Microsoft .NET, and so on.

Note: In this context, a *client application* can be two types of clients: One is a stand-alone client that uses the WebLogic client classes to invoke a Web Service hosted on both WebLogic Server and non-WebLogic Server application servers. The other type of client application that invokes a Web Service runs inside a J2EE component deployed to WebLogic Server, such as an EJB or another Web Service.

The sections that follow describe how to use BEA's implementation of the JAX-RPC specification (Version 1.1) 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. In addition, you can create a stand-alone client application or one that runs as part of a WebLogic Server.

Warning: You cannot use a dynamic client to invoke a Web Service operation that implements user-defined data types as parameters or return values. A dynamic client uses the JAX-RPC Call interface. Standard (static) clients use the Service and Stub JAX-RPC interfaces, which correctly invoke Web Services that implement user-defined data types.

Types of Client Applications

This section describes two different types of client applications:

- Stand-alone—A stand-alone client application, in its simplest form, is a Java program that has the `Main` public class that you invoke with the `java` command. It runs completely separately from WebLogic Server.
- A J2EE component deployed to WebLogic Server—In this type of client application, the Web Service invoke is part of the code that implements an EJB, servlet, or another Web Service. This type of client application, therefore, runs inside a WebLogic Server container.

JAX-RPC

The Java API for XML based RPC (JAX-RPC) is a Sun Microsystems specification that defines the APIs used to invoke a Web Service. WebLogic Server implements the JAX-RPC 1.1 specification.

The following table briefly describes the core JAX-RPC interfaces and classes.

Table 9-1 JAX-RPC Interfaces and Classes

javax.xml.rpc Interface or Class	Description
Service	Main client interface.
ServiceFactory	Factory class for creating `Service` instances.
Stub	Base class of the client proxy used to invoke the operations of a Web Service.

Table 9-1 JAX-RPC Interfaces and Classes

javax.xml.rpc Interface or Class	Description
Call	Used to dynamically invoke a Web Service.
JAXRPCException	Exception thrown if an error occurs while invoking a Web Service.

For detailed information on JAX-RPC, see http://java.sun.com/xml/jaxrpc/index.html.

For a tutorial that describes how to use JAX-RPC to invoke Web Services, see http://java.sun.com/webservices/docs/ea1/tutorial/doc/JAXRPC.html.

The clientgen Ant Task

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 source code for the JAX-RPC `Stub` and `Service` interface implementations for the particular Web Service you want to invoke.
- The Java source code for any user-defined XML Schema data types included in the WSDL file.
- The JAX-RPC mapping deployment descriptor file which contains information about the mapping between the Java user-defined data types and their corresponding XML Schema types in the WSDL file.
- A client-side copy of the WSDL file.

For additional information about the `clientgen` Ant task, such as all the available attributes, see Appendix A, "Ant Task Reference."

Examples of Clients That Invoke Web Services

WebLogic Server includes examples of creating and invoking WebLogic Web Services in the `WL_HOME/samples/server/examples/src/examples/webservices` directory, where `WL_HOME` refers to the main WebLogic Server directory.

For detailed instructions on how to build and run the examples, open the *WL_HOME*/samples/server/docs/index.html Web page in your browser and expand the **WebLogic Server Examples->Examples->API->Web Services** node.

Invoking a Web Service from a Stand-alone Client: Main Steps

In the following procedure 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 file that you want to update with Web Services client tasks.

For general information about using Ant in your development environment, see "Creating the Basic Ant build.xml File" on page 4-5. For a full example of a build.xml file used in this section, see "Sample Ant Build File for a Stand-Alone Java Client" on page 9-10.

To create a Java stand-alone client application that invokes a Web Service:

1. Open a command shell and set your environment.

   On Windows NT, execute the setDomainEnv.cmd command, located in your domain directory. The default location of WebLogic Server domains is *BEA_HOME*\user_projects\domains*domainName*, where *BEA_HOME* is the top-level installation directory of the BEA products and *domainName* is the name of your domain.

   On UNIX, execute the setDomainEnv.sh command, located in your domain directory. The default location of WebLogic Server domains is *BEA_HOME*/user_projects/domains/*domainName*, where *BEA_HOME* is the top-level installation directory of the BEA products and *domainName* is the name of your domain.

2. Update your build.xml file to execute the clientgen Ant task to generate the needed client-side artifacts to invoke a Web Service.

   See "Using the clientgen Ant Task To Generate Client Artifacts" on page 9-5.

3. Get information about the Web Service, such as the signature of its operations and the name of the ports.

   See "Getting Information About a Web Service" on page 9-6.

4. Write the client application Java code that includes an invoke of the Web Service operation.

   See "Writing the Java Client Application Code" on page 9-7.

5. Compile and run your Java client application.

   See "Compiling and Running the Client Application" on page 9-8.

Using the clientgen Ant Task To Generate Client Artifacts

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

```
<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"/>

</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.

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.

Note: The package of the Java user-defined data type is based on the XML Schema of the data type in the WSDL, which is different from the package name of the JAX-RPC stubs.

See "Sample Ant Build File for a Stand-Alone Java Client" on page 9-10 for a full sample `build.xml` file that contains additional targets from those described in this procedure, such as `clean`.

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.

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 JAX-RPC stubs 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 `get`*`PortName`*`()` 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 you are invoking a WebLogic Web Service you implemented with a JWS file, the name of the Web Service is specified using the `serviceName` attribute of the `@WebService` JWS annotation and the name of the port is specified using the `portName` attribute of the `@WLHttpTransport` annotation.
- 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 you are invoking a WebLogic Web Service you implemented with a JWS file, the port type is specified using the `name` attribute of the `@WebService` JWS annotation.

You can also examine the actual WSDL of the Web Service; see "Browsing to the WSDL of the Web Service" on page 4-15 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>
```

Writing the Java Client Application Code

In the following code example, a stand-alone application invokes a Web Service operation.

The client application takes a single argument: the WSDL of the Web Service. The application then uses standard JAX-RPC 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.complex.BasicStruct`) as an input parameter and return value. The `clientgen` Ant task automatically generates the Java code for this user-defined data type.

```
package examples.webservices.simple_client;

import java.rmi.RemoteException;

import javax.xml.rpc.ServiceException;

// import the BasicStruct class, used as a param and return value of the
// echoComplexType operation.  The class is generated automatically by
// the clientgen Ant task.

import examples.webservices.complex.BasicStruct;

/**
 * This is a simple stand-alone client application that invokes the
 * the echoComplexType operation of the ComplexService Web service.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public class Main {

  public static void main(String[] args)
      throws ServiceException, RemoteException{

    ComplexService service = new ComplexService_Impl (args[0]);
    ComplexPortType port = service.getComplexServicePort();

    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());
  }
}
```

In the preceding example:

- The following code shows how to create a `ComplexPortType` stub:

  ```
  ComplexService service = new ComplexService_Impl (args[0]);
  ComplexPortType port = service.getComplexServicePort();
  ```

  The `ComplexService_Impl` stub factory implements the JAX-RPC `Service` interface. The constructor of `ComplexService_Impl` creates a stub based on the provided WSDL URI (`args[0]`). The `getComplexServicePort()` 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:

  ```
  BasicStruct result = port.echoComplexType(in);
  ```

  The `echoComplexType` operation returns the user-defined data type called `BasicStruct`.

The method of your application that invokes the Web Service operation must throw or catch `java.rmi.RemoteException` and `javax.xml.rpc.ServiceException`, both of which are thrown from the generated JAX-RPC stubs.

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

```
<target name="build-client">

  <clientgen

wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
      destDir="clientclasses"
      packageName="examples.webservices.simple_client"/>

  <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 proto-typing, 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. You must also copy the following `clientgen`-generated files from `clientgen`'s destination directory to `javac`'s destination directory, keeping the same sub-directory hierarchy in the destination:

```
packageName/ServiceName_internaldd.xml
packageName/ServiceName_java_wsdl_mapping.xml
packageName/ServiceName_saved_wsdl.wsdl
```

where *`packageName`* refers to the subdirectory hierarchy that corresponds to the package of the generated JAX-RPC stubs and *`ServiceName`* refers to the name of the Web Service.

To run the client application, add a `run` target to the `build.xml` that includes a call to the `java` task, as shown below:

```
<path id="client.class.path">
    <pathelement path="clientclasses"/>
    <pathelement path="${java.class.path}"/>
</path>

<target name="run" >
    <java
       fork="true"
       classname="examples.webServices.simple_client.Main"
       failonerror="true" >
       <classpath refid="client.class.path"/>
        <arg
line="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
```

```
    />
        </java>
    </target>
```

The `path` task adds the `clientclasses` directory to the CLASSPATH. The `run` target invokes the `Main` application, passing it the WSDL of the deployed Web Service as its single argument.

See "Sample Ant Build File for a Stand-Alone Java Client" on page 9-10 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.

Sample Ant Build File for a Stand-Alone Java Client

```
<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"/>

    <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"/>
      <arg
line="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
      />
    </java>
  </target>

</project>
```

Invoking a Web Service from Another Web Service

Invoking a Web Service from within a WebLogic Web Service is similar to invoking one from a stand-alone Java application, as described in "Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4. In particular, you also use the `clientgen` Ant task to generate the JAX-RPC stubs of the Web Service to be invoked, and use the same standard JAX-RPC APIs to get Service and Port Type instances to invoke the Web Service operations. This section describes the differences between invoking a Web Service from a client in a J2EE component and invoking from a stand-alone client.

It is assumed that you have read and understood "Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4. It is also 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.

In particular, you still use clientgen to create the client part of your Web Service and then you use jwsc to compile this client and create a Web Service from it.

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 "Sample build.xml File for a Web Service Client" on page 9-13 for the full sample build.xml file:

- In the target of your build.xml file, run the clientgen Ant task *before* you run jwsc to compile the client Web Service, because jwsc needs the JAX-RPC stubs generated by clientgen to complete the compile. Set the destdir attribute of clientgen to a temporary directory.
- Add a javac task to compile the clientgen-generated Java code into class files. Set both the srcdir and destdir attributes to the temporary directory.
- Add the classpathref attribute to the jwsc Ant task to point to the temporary directory that contains the clientgen-generated stubs.
- Add a copy target to copy the clientgen-generated files from the temporary directory to the APP-INF/classes directory of the jwsc-generated Enterprise Application. The client Web Service uses this copy to find the needed JAX-RPC stubs when it invokes the other Web Service.

  Note: The APP-INF/classes directory is a WebLogic-specific feature for sharing classes in an Enterprise application.

The following bullets describe the changes you must make to the JWS file that implements the client Web Service; see "Sample JWS File That Invokes a Web Service" on page 9-15 for the full JWS file example.

- Import the files generated by the clientgen Ant task. These include the JAX-RPC stubs 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: The user-defined data types are generated into a package based on the XML Schema of the data type in the WSDL, *not* in the package specified by clientgen. The JAX-RPC stubs, however, use the package name specified by the packageName clientgen attribute.

- The method that contains the invoke of the Web Service must either throw or catch both java.rmi.RemoteException and javax.xml.rpc.ServiceException.

- Get the Service and PortType JAX-RPC stubs and invoke the operation on the port as usual; see "Writing the Java Client Application Code" on page 9-7 for details.

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 a simple Java stand-alone client are shown in bold.

The `build-service` target first calls `clientgen` to generate the JAX-RPC stubs for the invoked Web Service; the code is generated into a temporary directory. The `javac` task compiles the generated code into class files. The `jwsc` Ant task then compiles the client Web Service, whose JWS file includes JAX-RPC API calls to create the Service and PortType instances and invoke the operations of the Web Service. Because the JWS file imports the `clientgen`-generated stubs, the `jwsc` Ant task uses the `classpathref` attribute to reference the temporary directory that contains these stubs. Finally, the `copy` task copies the `clientgen`-generated stubs into the `APP-INF/classes` directory of the Enterprise Application which contains the client Web Service.

```
<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="clientService.ear.deployed.name" value="ClientServiceEar" />
  <property name="example-output" value="output" />
  <property name="tempjar-dir" value="${example-output}/tempjardir" />
  <property name="clientService-ear-dir"
           value="${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>

  <path id="ws.clientService.class.path">
    <pathelement path="${tempjar-dir}"/>
    <pathelement path="${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">

  <clientgen
    wsdl="http://${wls.hostname}:${wls.port}/complex/ComplexService?WSDL"
    destDir="${tempjar-dir}"
    packageName="examples.webservices.service_to_service"/>

  <javac
    source="1.5"
    srcdir="${tempjar-dir}"
    destdir="${tempjar-dir}"
    includes="**/*.java"/>

  <jwsc
      srcdir="src"
      destdir="${clientService-ear-dir}"
      classpathref="ws.clientService.class.path">

      <jws
     file="examples/webservices/service_to_service/ClientServiceImpl.java" />

  </jwsc>

  <copy todir="${clientService-ear-dir}/app-inf/classes">
       <fileset dir="${tempjar-dir}" />
  </copy>

</target>

<target name="deploy">
  <wldeploy action="deploy" name="${clientService.ear.deployed.name}"
    source="${clientService-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="${clientService.ear.deployed.name}"
      failonerror="false"
      user="${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}/ClientService/ClientService?WSDL"
      destDir="${clientclass-dir}"
      packageName="examples.webservices.service_to_service.client"/>

    <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"/>
          <arg

line="http://${wls.hostname}:${wls.port}/ClientService/ClientService"/>
    </java>

  </target>

</project>
```

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.

```
package examples.webservices.service_to_service;
```

```
import java.rmi.RemoteException;
import javax.xml.rpc.ServiceException;

import javax.jws.WebService;
import javax.jws.WebMethod;

import weblogic.jws.WLHttpTransport;

// Import the BasicStruct data type, generated by clientgen and used
// by the ComplexService Web Service

import examples.webservices.complex.BasicStruct;

// Import the JAX-RPC Stubs for invoking the ComplexService Web Service.
// Stubs generated by clientgen

import examples.webservices.service_to_service.ComplexPortType;
import examples.webservices.service_to_service.ComplexService_Impl;
import examples.webservices.service_to_service.ComplexService;

@WebService(name="ClientPortType", serviceName="ClientService",
            targetNamespace="http://examples.org")

@WLHttpTransport(contextPath="ClientService", serviceUri="ClientService",
                 portName="ClientServicePort")

public class ClientServiceImpl {

  @WebMethod()
  public String callComplexService(BasicStruct input, String serviceUrl)
      throws ServiceException, RemoteException
  {

    // Create service and port stubs to invoke ComplexService
    ComplexService service = new ComplexService_Impl(serviceUrl + "?WSDL");
    ComplexPortType port = service.getComplexServicePort();

    // 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; see the output of `clientgen` for the full classname structure. In this example, the `ComplexService` uses the `BasicStruct` JavaBean:

```
import examples.webservices.complex.BasicStruct;
```

- Import the JAX-RPC stubs of the `ComplexService` Web Service; the stubs are generated by `clientgen`:

```
import examples.webservices.service_to_service.ComplexPortType;
import examples.webservices.service_to_service.ComplexService_Impl;
import examples.webservices.service_to_service.ComplexService;
```

- Ensure that your client Web Service throws or catches `ServiceException` and `RemoteException`:

```
throws ServiceException, RemoteException
```

- Create the JAX-RPC Service and Port instances for the ComplexService:

```
ComplexService service = new
     ComplexService_Impl(serviceUrl + "?WSDL");
ComplexPortType port = service.getComplexServicePort();
```

- Invoke the `echoComplexType` operation of `ComplexService` using the port you just instantiated:

```
BasicStruct result = port.echoComplexType(input);
```

Creating and Using Client-Side SOAP Message Handlers

The section "Creating and Using SOAP Message Handlers" on page 7-6 describes how to create server-side SOAP message handlers that execute as part of the Web Service running on WebLogic Server. You can also create client-side handlers that execute as part of the client application that *invokes* a Web Service operation. 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

You create the actual Java client-side handler in the same way you create a server-side handler: write a Java class that extends the `javax.xml.rpc.handler.GenericHandler` abstract class. 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.

Similar to the server-side SOAP handler programming, you use an XML file to specify to the clientgen Ant task that you want to invoke client-side SOAP message handlers. However, the XML Schema of this XML file is slightly different, as described in the following procedure.

Using Client-Side SOAP Message Handlers: Main Steps

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 already 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 "Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4.

1. Design the client-side SOAP handlers and the handler chain which specifies the order in which they execute. This step is almost exactly the same as that of designing the server-side SOAP message handlers, except the perspective is from the client application, rather than a Web Service.

   See "Designing the SOAP Message Handlers and Handler Chains" on page 7-9.

2. For each handler in the handler chain, create a Java class that extends the `javax.xml.rpc.handler.GenericHandler` abstract class. This step is very similar to the corresponding server-side step, except that the handler executes in a chain in the client rather than the server.

   See "Creating the GenericHandler Class" on page 7-12 for details about programming a handler class. See "Example of a Client-Side Handler Class" on page 9-19 for an example.

3. Create the client-side SOAP handler configuration file. This XML file describes the handlers in the handler chain, the order in which they execute, and any initialization parameters that should be sent.

   See "Creating the Client-Side SOAP Handler Configuration File" on page 9-20.

4. Update the `build.xml` file that builds your client application, specifying to the `clientgen` Ant task the name of the SOAP handler configuration file. Also ensure that the `build.xml` file compiles the handler files into Java classes and makes them available to your client application.

   See "Specifying the Client-Side SOAP Handler Configuration File to clientgen" on page 9-22.

5. Rebuild your client application by running the relevant task:

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

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 JAX-RPC stubs automatically take care of executing the handlers in the correct sequence.

Example of a Client-Side Handler Class

The following example shows a simple SOAP message handler class that you can configure for a client application that invokes a Web Service.

```
package examples.webservices.client_handler.client;

import javax.xml.namespace.QName;
import javax.xml.rpc.handler.HandlerInfo;
import javax.xml.rpc.handler.GenericHandler;
import javax.xml.rpc.handler.MessageContext;

public class ClientHandler1 extends GenericHandler {

  private QName[] headers;

  public void init(HandlerInfo hi) {
    System.out.println("in " + this.getClass() + " init()");
  }

  public boolean handleRequest(MessageContext context) {
    System.out.println("in " + this.getClass() + " handleRequest()");
    return true;
  }

  public boolean handleResponse(MessageContext context) {
    System.out.println("in " + this.getClass() + " handleResponse()");
    return true;
  }

  public boolean handleFault(MessageContext context) {
    System.out.println("in " + this.getClass() + " handleFault()");
    return true;
  }
```

```
  public QName[] getHeaders() {
    return headers;
  }
}
```

Creating the Client-Side SOAP Handler Configuration File

The client-side SOAP handler configuration file specifies the list of handlers in the handler chain, the order in which they execute, the initialization parameters, and so on. See "XML Schema for the Client-Side Handler Configuration File" on page 9-21 for a full description of this file.

The configuration file uses XML to describe a single handler chain that contains one or more handlers, as shown in the following simple example:

```
<weblogic-wsee-clientHandlerChain
  xmlns="http://www.bea.com/ns/weblogic/90"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:j2ee="http://java.sun.com/xml/ns/j2ee">

        <handler>
          <j2ee:handler-name>clienthandler1</j2ee:handler-name>

<j2ee:handler-class>examples.webservices.client_handler.client.ClientHandler1<
/j2ee:handler-class>
          <j2ee:init-param>
            <j2ee:param-name>ClientParam1</j2ee:param-name>
            <j2ee:param-value>value1</j2ee:param-value>
          </j2ee:init-param>
        </handler>

        <handler>
          <j2ee:handler-name>clienthandler2</j2ee:handler-name>

<j2ee:handler-class>examples.webservices.client_handler.client.ClientHandler2<
/j2ee:handler-class>
        </handler>

</weblogic-wsee-clientHandlerChain>
```

In the example, the handler chain contains two handlers: `clienthandler1` and `clienthandler2`, implemented with the class names specified with the `<j2ee:handler-class>` element. The two handlers execute in forward order directly before the client application sends the SOAP request to the Web Service, and then in reverse order directly after the client application receives the SOAP response from the Web Service.

The example also shows how to use the `<j2ee:init-param>` element to specify one or more initialization parameters to a handler.

Use the <soap-role>, <soap-header>, and <port-name> child elements of the <handler> element to specify the SOAP roles implemented by the handler, the SOAP headers processed by the handler, and the port-name element in the WSDL with which the handler is associated with, respectively.

XML Schema for the Client-Side Handler Configuration File

The following XML Schema file defines the structure of the client-side SOAP handler configuration file:

```
<?xml version="1.0" encoding="UTF-8"?>

<schema
  targetNamespace="http://www.bea.com/ns/weblogic/90"
  xmlns:wls="http://www.bea.com/ns/weblogic/90"
  xmlns:j2ee="http://java.sun.com/xml/ns/j2ee"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified"
  >
  <include schemaLocation="weblogic-j2ee.xsd"/>

  <element name="weblogic-wsee-clientHandlerChain"
           type="wls:weblogic-wsee-clientHandlerChainType">
       <xsd:key name="wsee-clienthandler-name-key">
            <xsd:annotation>
            <xsd:documentation>

            Defines the name of the handler. The name must be unique within the
            chain.

            </xsd:documentation>
            </xsd:annotation>
                <xsd:selector xpath="j2ee:handler"/>
                <xsd:field xpath="j2ee:handler-name"/>
       </xsd:key>
  </element>

  <complexType name="weblogic-wsee-clientHandlerChainType">
      <sequence>
        <xsd:element name="handler"
                     type="j2ee:service-ref_handlerType"
                     minOccurs="0" maxOccurs="unbounded">
        </xsd:element>
      </sequence>
  </complexType>
</schema>
```

A single configuration file specifies a single client-side handler chain. The root of the configuration file is `<weblogic-wsee-clientHandlerChain>`, and the file contains zero or more `<handler>` child elements, each of which describes a handler in the chain.

The structure of the `<handler>` element is described by the J2EE service-`ref_handlerType` complex type, specified in the J2EE 1.4 Web Service client XML Schema.

Specifying the Client-Side SOAP Handler Configuration File to clientgen

Use the `handlerChainFile` attribute of the `clientgen` Ant task to specify the client-side SOAP handler configuration file, as shown in the following excerpt from a `build.xml` file:

```
<clientgen
  wsdl="http://ariel:7001/handlers/ClientHandlerService?WSDL"
  destDir="${clientclass-dir}"
  handlerChainFile="ClientHandlerChain.xml"
  packageName="examples.webservices.client_handler.client"/>
```

The JAX-RPC stubs generated by `clientgen` automatically ensure that the handlers described by the configuration file execute in the correct order before and after the client application invokes the Web Service operation

Using a Client-Side Security WS-Policy File

The section "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4 describes how a WebLogic Web Service can be associated with one or more WS-Policy files that describe the message-level security of the Web Service. These WS-Policy files are XML files that describe how a SOAP message should be digitally signed or encrypted and what sort of user authentication is required from a client that invokes the Web Service. Typically, the WS-Policy file associated with a Web Service is attached to its WSDL, which the Web Services client runtime reads to determine whether and how to digitally sign and encrypt the SOAP message request from an operation invoke from the client application.

Sometimes, however, a Web Service might not attach the WS-Policy file to its deployed WSDL or the Web Service might be configured to not expose its WSDL at all. In these cases, the Web Services client runtime cannot determine from the service itself the security that must be enabled for the SOAP message request. Rather, it must load a client-side copy of the WS-Policy file. This section describes how to update a client application to load a local copy of a WS-Policy file.

The client-side WS-Policy file is typically exactly the same as the one associated with a deployed Web Service. If the two files are different, and there is a conflict in the security assertions contained in the files, then the invoke of the Web Service operation returns an error.

You can specify that the client-side WS-Policy file be associated with the SOAP message request, response, or both.

Associating a Client-Side WS-Policy File with a Client Application: Main Steps

The following procedure describes the high-level steps to associate a WS-Policy file 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 it by associating a client-side WS-Policy file. 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. See "Invoking a Web Service from a Stand-alone Client: Main Steps" on page 9-4.

1. Create the client-side WS-Policy file and save it in a location accessible by the client application. Typically, this WS-Policy file is the same as the one that is configured for the Web Service you are invoking, but because the server-side file is not exposed to the client runtime, the client application must load its own local copy.

   See "Creating and Using a Custom WS-Policy File" on page 10-20 for information about creating WS-Policy files.

   Warning: You can specify only a concrete client-side WS-Policy file to a client application; you cannot use abstract WS-Policy files or the three pre-packaged security WS-Policy files.

2. Update the `build.xml` file that builds your client application by specifying to the `clientgen` Ant task that it should generate additional `getXXXPort()` methods in the JAX-RPC stub, where *XXX* referes to the name of the Web Service. These methods are later used by the client application to load the client-side WS-Policy file.

   See "Updating clientgen to Generate Methods That Load a WS-Policy File" on page 9-24.

3. Update your Java client application to load the client-side WS-Policy file using the additional methods that the `clientgen` Ant task generates.

   See "Updating a Client Application To Load a WS-Policy File" on page 9-24.

4. Rebuild your client application by running the relevant task. For example:

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

When you next run the client application, it will load a local copy of the WS-Policy file that the Web Service client runtime uses to enable security for the SOAP request message.

Updating clientgen to Generate Methods That Load a WS-Policy File

Set the `generatePolicyMethods` attribute of the `clientgen` Ant task to `true` to specify that the Ant task should generate additional `getXXX()` methods in the implementation of the JAX-RPC `Service` interface for loading a client-side copy of a WS-Policy file when you get a port, as shown in the following example:

```
<clientgen
  wsdl="http://ariel:7001/policy/ClientPolicyService?WSDL"
  destDir="${clientclass-dir}"
  generatePolicyMethods="true"
  packageName="examples.webservices.client_policy.client"/>
```

See "Updating a Client Application To Load a WS-Policy File" on page 9-24 for a description of the additional methods that are generated and how to use them in a client application.

Updating a Client Application To Load a WS-Policy File

When you set `generatePolicyMethods="true"` for `clientgen`, the Ant task generates the following additional methods in the implementation of the JAX-RPC `Service` interface, where *XXX* refers to the name of the Web Service port:

- `getXXX(java.io.InputStream policyInputStream);`

  Loads a client-side WS-Policy file from an InputStream and applies it to both the SOAP request (inbound) and response (outbound) messages.

- `getXXX(java.io.InputStream policyInputStream, boolean inbound, boolean outbound);`

  Loads a client-side WS-Policy file from an `InputStream` and applies it to either the SOAP request or response messages, depending on the Boolean value of the second and third parameters.

- `getXXX(java.net.URI policyURI);`

  Loads a client-side WS-Policy file from a URI and applies it to both the SOAP request and response messages.

- `getXXX(java.net.URI policyURI, boolean inbound, boolean outbound);`

Loads a client-side WS-Policy file from a URI and applies it to either the SOAP request or response messages, depending on the Boolean value of the second and third parameters.

Use these methods, rather than the normal `getXXX()` method with no parameters, for getting a port and specifying at the same time that any operation invokes using that port have an associated WS-Policy file.

The following simple client application shows an example of using these policy methods; the code in bold is described after the example.

```
package examples.webservices.client_policy.client;

import java.rmi.RemoteException;

import javax.xml.rpc.ServiceException;
import javax.xml.rpc.Stub;

import java.io.FileInputStream;
import java.io.IOException;

/**
 * This is a simple stand-alone client application that invokes the
 * the <code>sayHello</code> operation of the ClientPolicyService Web service.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public class Main {

  public static void main(String[] args)
      throws ServiceException, RemoteException, IOException {

      FileInputStream policy_file = new FileInputStream(args[1]);

      ClientPolicyService service = new ClientPolicyService_Impl(args[0] +
"?WSDL");
      ClientPolicyPortType normal_port = service.getClientPolicyPort();

      ClientPolicyPortType policy_port =
service.getClientPolicyPort(policy_file, true, false);

    try {
      String result = null;
      result = policy_port.sayHello("Hi there!");
      System.out.println( "Got result: " + result );
    } catch (RemoteException e) {
      throw e;
    }
  }
}
```

The second argument to the client application is the WS-Policy file, from which the application makes a `FileInputStream` instance. The `normal_port` uses the standard parameterless method for getting a port; the `policy_port`, however, uses one of the additional policy methods to specify that any invoke of an operation using the port have an associated WS-policy file, but only for the SOAP request:

```
      ClientPolicyPortType policy_port =
service.getClientPolicyPort(policy_file, true, false);
```

Configuring Security

The following sections describe how to configure security for your Web Service:

- "Overview of Web Services Security" on page 10-1
- "What Type of Security Should You Configure?" on page 10-2
- "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
- "Configuring Transport-Level Security" on page 10-33
- "Configuring Access Control Security: Main Steps" on page 10-35

Overview of Web Services Security

To secure your WebLogic Web Service, you configure one or more of three different types of security:

- Message-level security, in which data in a SOAP message is digitally signed or encrypted.

  See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2.

- Transport-level security, in which SSL is used to secure the connection between a client application and the Web Service.

  See "Configuring Transport-Level Security" on page 10-33.

- Access control security, which specifies which roles are allowed to access Web Services.

  See "Configuring Access Control Security: Main Steps" on page 10-35.

What Type of Security Should You Configure?

Access control security answers the question "who can do what?" First you specify the roles that are allowed to access a Web Service. Then, when a client application attempts to invoke a Web Service operation, the client authenticates itself to WebLogic Server, and if the client has the authorization, it is allowed to continue with the invocation. Access control security secures only WebLogic Server resources. That is, if you configure *only* access control security, the connection between the client application and WebLogic Server is not secure and the SOAP message is in plain text.

With **transport-level security**, you secure the connection between the client application and WebLogic Server with Secure Sockets Layer (SSL). SSL provides secure connections by allowing two applications connecting over a network to authenticate the other's identity and by encrypting the data exchanged between the applications. Authentication allows a server, and optionally a client, to verify the identity of the application on the other end of a network connection. Encryption makes data transmitted over the network intelligible only to the intended recipient.

Transport-level security, however, secures only the connection itself. This means that if there is an intermediary between the client and WebLogic Server, such as a router or message queue, the intermediary gets the SOAP message in plain text. When the intermediary sends the message to a second receiver, the second receiver does not know who the original sender was. Additionally, the encryption used by SSL is "all or nothing": either the entire SOAP message is encrypted or it is not encrypted at all. There is no way to specify that only selected parts of the SOAP message be encrypted.

Message-level security includes all the security benefits of SSL, but with additional flexibility and features. Message-level security is end-to-end, which means that a SOAP message is secure even when the transmission involves one or more intermediaries. The SOAP message itself is digitally signed and encrypted, rather than just the connection. And finally, you can specify that only parts of the message be signed or encrypted.

Configuring Message-Level Security (Digital Signatures and Encryption)

Message-level security specifies whether the SOAP messages between a client application and the Web Service it is invoking should be digitally signed or encrypted or both.

WebLogic Web Services implement the following OASIS Standard 1.0 Web Services Security specifications, dated April 6, 2004:

- Web Services Security: SOAP Message Security
- Web Services Security: Username Token Profile
- Web Services Security: X.509 Certificate Token Profile
- Web Services Security: SAML Token Profile

These specifications provide security token propagation, message integrity, and message confidentiality. These mechanisms can be used independently (such as passing a username token for user authentication) or together (such as digitally signing and encrypting a SOAP message and specifying that a user must use X.509 certificates for authentication).

You configure message-level security for a Web Service by attaching one or more WS-Policy files that contain security policy statements, as specified by the WS-Policy (dated September 2004) specification. See "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4 for detailed information about how the Web Services runtime environment uses these files.

See "Configuring Simple Message-Level Security: Main Steps" on page 10-8 for the basic steps you must perform to configure simple message-level security. This section discusses configuration of the Web Services runtime environment, as well as configuration of message-level security for a particular Web Service and how to code a client application to invoke the service.

You can also configure message-level security for a Web Service at runtime, after a Web Service has been deployed. See "Associating WS-Policy Files at Runtime Using the Administration Console" on page 10-24 for details.

Note: You cannot digitally sign or encrypt a SOAP attachment.

Main Use Cases

BEA's implementation of the *Web Services Security: SOAP Message Security* specification supports the following use cases:

- Use X.509 certificates to sign and encrypt a SOAP message, starting from the client application that invokes the message-secured Web Service, to the WebLogic Server instance that is hosting the Web Service and back to the client application.
- Specify the SOAP message targets that are signed or encrypted: the body, specific SOAP headers, or specific elements.
- Include a username, SAML, or X.509 token in the SOAP message for authentication.

Using WS-Policy Files for Message-Level Security Configuration

You specify the details of message-level security for a WebLogic Web Service with one or more WS-Policy files. The WS-Policy specification provides a general purpose model and XML syntax to describe and communicate the policies of a Web Service.

The WS-Policy files used for message-level security are XML files that describe whether and how the SOAP messages resulting from an invoke of an operation should be digitally signed or encrypted. They can also specify that a client application authenticate itself using a username, SAML, or X.509 token.

Note: The policy assertions used in the WS-Policy file to configure message-level security for a WebLogic Web Service are *based* on the assertions described in the December 18, 2002 version of the *Web Services Security Policy Language* (WS-SecurityPolicy) specification. This means that although the exact syntax and usage of the assertions in WebLogic Server are different, they are similar in meaning to those described in the specification. The assertions in this release of WebLogic Server are *not* based on the latest update of the specification (13 July 2005.)

You use the `@Policy` and `@Policies` JWS annotations in your JWS file to associate WS-Policy files with your Web Service. You can associate any number of WS-Policy files with a Web Service, although it is up to you to ensure that the assertions do not contradict each other. You can specify a WS-Policy file at both the class- and method-level of your JWS file.

WebLogic Server and Custom WS-Policy Files

WebLogic Server includes three simple WS-Policy files that you can specify in your JWS file if you do not want to create your own WS-Policy files: `Auth.xml`, `Encrypt.xml`, and `Sign.xml`. BEA recommends that unless you have specific security needs, you use these pre-packaged files as often as possible.

You must create your own WS-Policy file if you want to:

- Use SAML tokens for authentication.
- Specify that particular parts of the body of a SOAP message be encrypted or digitally signed, rather than the entire body, which is what the `Encrypt.xml` and `Sign.xml` pre-packaged WS-Policy files do.

See “Auth.xml” on page 10-5, “Sign.xml” on page 10-5, and “Encrypt.xml” on page 10-7 for descriptions and listings of the three pre-packaged WS-Policy files. See “Creating and Using a Custom WS-Policy File” on page 10-20 for information about creating your own WS-Policy file.

Auth.xml

The WebLogic Server `Auth.xml` file, shown below, specifies that the client application invoking the Web Service must authenticate itself with one of the tokens (username or X.509) that support authentication.

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

  >

  <wssp:Identity/>

</wsp:Policy>
```

Sign.xml

The WebLogic Server `Sign.xml` file specifies that the body and WebLogic-specific system headers of the SOAP message be digitally signed. It also specifies that the SOAP message include a Timestamp, which is digitally signed, and that the token used for signing is also digitally signed. The token used for signing is included in the SOAP message.

The following headers are signed when using the `Sign.xml` WS-Policy file:

- `SequenceAcknowledgement`
- `AckRequested`
- `Sequence`
- `Action`
- `FaultTo`
- `From`
- `MessageID`
- `RelatesTo`

- ReplyTo
- To
- SetCookie
- Timestamp

The WebLogic Server Sign.xml file is shown below:

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-
utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >

  <wssp:Integrity>

    <wssp:SignatureAlgorithm URI="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>

    <wssp:CanonicalizationAlgorithm
          URI="http://www.w3.org/2001/10/xml-exc-c14n#"/>

    <wssp:Target>
      <wssp:DigestAlgorithm URI="http://www.w3.org/2000/09/xmldsig#sha1" />
      <wssp:MessageParts
          Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
          wls:SystemHeaders()
      </wssp:MessageParts>
    </wssp:Target>

    <wssp:Target>
      <wssp:DigestAlgorithm URI="http://www.w3.org/2000/09/xmldsig#sha1" />
      <wssp:MessageParts
          Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
          wls:SecurityHeader(wsu:Timestamp)
      </wssp:MessageParts>
    </wssp:Target>

    <wssp:Target>
      <wssp:DigestAlgorithm URI="http://www.w3.org/2000/09/xmldsig#sha1" />
      <wssp:MessageParts
          Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
          wsp:Body()
      </wssp:MessageParts>
    </wssp:Target>
```

```
  </wssp:Integrity>

  <wssp:MessageAge/>

</wsp:Policy>
```

Encrypt.xml

The WebLogic Server `Encrypt.xml` file specifies that the entire body of the SOAP message be encrypted. By default, the encryption token is *not* included in the SOAP message.

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"
  >

  <wssp:Confidentiality>
    <wssp:KeyWrappingAlgorithm URI="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
    <wssp:Target>
      <wssp:EncryptionAlgorithm
         URI="http://www.w3.org/2001/04/xmlenc#tripledes-cbc"/>
      <wssp:MessageParts
         Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
         wsp:Body()
      </wssp:MessageParts>
    </wssp:Target>
    <wssp:KeyInfo/>
  </wssp:Confidentiality>

</wsp:Policy>
```

Abstract and Concrete WS-Policy Files

The WebLogic Web Services runtime environment recognizes two slightly different types of WS-Policy files: *abstract* and *concrete*. The pre-packaged WS-Policy files `Auth.xml`, `Encrypt.xml`, and `Sign.xml` are all abstract.

Abstract WS-Policy files do not explicitly specify the security tokens that are used for authentication, encryption, and digital signatures, but rather, the Web Services runtime environment determines the security tokens when the Web Service is deployed. Specifically, this means the `<Identity>` and `<Integrity>` elements (or assertions) of the `Auth.xml` and `Sign.xml` WS-Policy files, respectively, do not contain a `<SupportedTokens><SecurityToken>` child element, and the `<Confidentiality>` element of the `Encrypt.xml` WS-Policy file does not contain a `<KeyInfo><SecurityToken>` child element.

If your Web Service is associated with only these WS-Policy files, then client authentication requires username tokens. In this release of WebLogic Server, Web Services support only one type of token for encryption and digital signatures (`X.509`), which means that in the case of the `<Integrity>` and `<Confidentiality>` elements, concrete and abstract WS-Policy files end up being the same.

If your Web Service is associated with an abstract WS-Policy file and it is published as an attachment to the WSDL (which is the default behavior), the static WSDL file packaged in the Web Service archive file (JAR or WAR) will be slightly different than the dynamic WSDL of the deployed Web Service. This is because the static WSDL, being abstract, does not include specific `<SecurityToken>` elements, but the dynamic WSDL *does* include these elements because the Web Services runtime has automatically filled them in when it deployed the service. For this reason, in the code that creates the JAX-RPC stub in your client application, ensure that you specify the dynamic WSDL or you will get a runtime error when you try to invoke an operation:

```
HelloService service = new HelloService(Dynamic_WSDL);
```

You can specify either the static or dynamic WSDL to the `clientgen` Ant task in this case. See "Browsing to the WSDL of the Web Service" on page 4-15 for information on viewing the dynamic WSDL of a deployed Web Service.

Concrete WS-Policy files explicitly specify the details of the security tokens at the time the Web Service is programmed. Programmers create concrete WS-Policy files when they know, at the time they are programming the service, the details of the type of authentication (such as using `x509` or `SAML` tokens); whether multiple private key and certificate pairs from the keystore are going to be used for encryption and digital signatures; and so on.

Configuring Simple Message-Level Security: Main Steps

The following procedure describes how to configure simple message-level security for the Web Services security runtime, a particular WebLogic Web Service, and a client application that invokes an operation of the Web Service. In this document, *simple message-level security* is defined as follows:

- The message-secured Web Service uses the pre-packaged WS-Policy files (`Auth.xml`, `Sign.xml`, and `Encrypt.xml`) to specify its security requirements, rather than a user-created WS-Policy file. See "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4 for a description of these files.

- The Web Service makes its associated WS-Policy files publicly available by attaching them to its deployed WSDL, which is also publicly visible.
- The Web Services runtime uses the out-of-the-box private key and X.509 certificate pairs, store in the default keystores, for its encryption and digital signatures, rather than its own key pairs. These out-of-the-box pairs are also used by the core WebLogic Server security subsystem for SSL and are provided for demonstration and testing purposes. For this reason BEA highly recommends you use your own keystore and key pair in production. To use key pairs other than out-of-the-box pairs, see "Using Key Pairs Other Than the Out-Of-The-Box SSL Pair" on page 10-17.

  Warning: If you plan to deploy the Web Service to a cluster in which different WebLogic Server instances are running on different computers, you *must* use a keystore and key pair other than the out-of-the-box ones, even for testing purposes. The reason is that the key pairs in the default WebLogic Server keystore, `DemoIdentity.jks`, are not guaranteed to be the same across WebLogic Servers running on different machines. If you were to use the default keystore, the WSDL of the deployed Web Service would specify the public key from one of these keystores, but the invoke of the service might actually be handled by a server running on a different computer, and in this case the server's private key would not match the published public key and the invoke would fail. This problem only occurs if you use the default keystore and key pairs in a cluster, and is easily resolved by using your own keystore and key pairs.

- The client invoking the Web Service uses a username token to authenticate itself, rather than an X.509 token.
- The client invoking the Web Service is a stand-alone Java application, rather than a module running in WebLogic Server.

Later sections describe some of the preceding scenarios in more detail, as well as additional Web Services security uses cases that build on the simple message-level security use case.

It is assumed in the following procedure that you have already created a JWS file that implements a WebLogic Web Service and you want to update it so that the SOAP messages are digitally signed and encrypted. It is also assumed that you use Ant build scripts to iteratively develop your Web Service and that you have a working `build.xml` file that you can update with new information. Finally, it is assumed that you have a client application that invokes the non-secured Web Service. If these assumptions are not true, see:

- Chapter 5, "Programming the JWS File"
- Chapter 4, "Iterative Development of WebLogic Web Services"

- Chapter 9, "Invoking Web Services"

To configure simple message-level security for a WebLogic Web Service:

1. Update your JWS file, adding WebLogic-specific `@Policy` and `@Policies` JWS annotations to specify the pre-packaged WS-Policy files that are attached to either the entire Web Service or to particular operations.

   See "Updating the JWS File with @Policy and @Policies Annotations" on page 10-11, which describes how to specify *any* WS-Policy file. For this basic procedure, follow only the instructions for specifying the pre-packaged WS-Policy files: `Auth.xml`, `Sign.xml` and `Encrypt.xml`.

2. Recompile and redeploy your Web Service as part of the normal iterative development process.

   See "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2.

3. Create a keystore used by the client application. BEA recommends that you create one client keystore per application user.

   You can use the Cert Gen utility or Sun Microsystem's `keytool` utility to perform this step. For development purposes, the `keytool` utility is the easiest way to get started.

   See *Obtaining Private Keys and Digital Signatures* at http://e-docs.bea.com/wls/docs90/secmanage/identity_trust.html#get_keys_certs_trustedcas.

4. Create a private key and digital certificate pair, and load it into the client keystore. The same pair will be used to both digitally sign the client's SOAP request and encrypt the SOAP responses from WebLogic Server.

   Make sure that the certificate's key usage allows both encryption and digital signatures. Also see "Ensuring That WebLogic Server Can Validate the Client's Certificate" on page 10-11 for information about how WebLogic Server ensures that the client's certificate is valid.

   Warning: BEA requires a key length of 1024 bits or larger.

   You can use Sun Microsystem's `keytool` utility to perform this step.

   See *Obtaining Private Keys and Digital Signatures*.

5. Using the Administration Console, create users for authentication in your security realm.

   See *Users, Groups, and Security Roles*.

6. Update your client application to invoke the message-secured Web Service.

See "Updating a Client Application to Invoke a Message-Secured Web Service" on page 10-14.

See the following sections for information about additional Web Service security uses cases that build on the basic message-level security use case:

- "Using Key Pairs Other Than the Out-Of-The-Box SSL Pair" on page 10-17
- "Setting the SOAP Message Expiration" on page 10-19
- "Creating and Using a Custom WS-Policy File" on page 10-20
- "Associating WS-Policy Files at Runtime Using the Administration Console" on page 10-24
- "Using Security Assertion Markup Language (SAML) Tokens For Identity" on page 10-24
- "Using X.509 Certificate Tokens for Identity" on page 10-28
- "Using a Password Digest In the SOAP Message Rather Than Plaintext" on page 10-29
- "Invoking a Message-Secured Web Service From A Client Running in a WebLogic Server Instance" on page 10-31
- "Associating a Web Service with a Security Configuration Other Than the Default" on page 10-32

Ensuring That WebLogic Server Can Validate the Client's Certificate

You must ensure that WebLogic Server is able to validate the X.509 certificate that the client uses to digitally sign its SOAP request, and that WebLogic Server in turn uses to encrypt its SOAP responses to the client. Do one of the following:

- Ensure that the client application obtains a digital certificate that WebLogic Server automatically trusts, because it has been issued by a trusted certificate authority.
- Create a certificate registry which lists all the individual certificates trusted by WebLogic Server, and then ensure that the client uses one of these registered certificates.

For more information, see SSL Certificate Validation.

Updating the JWS File with @Policy and @Policies Annotations

Use the `@Policy` and `@Policies` annotations in your JWS file to specify that the Web Service has one or more WS-Policy files attached to it. You can use these annotations at either the class or method level.

The `@Policies` annotation simply groups two or more `@Policy` annotations together. Use the `@Policies` annotation if you want to attach two or more WS-Policy files to the class or method. If you want to attach just one WS-Policy file, you can use `@Policy` on its own.

The `@Policy` annotation specifies a single WS-Policy file, where it is located, whether the policy applies to the request or response SOAP message (or both), and whether to attach the WS-Policy file to the public WSDL of the service.

Use the `uri` attribute to specify the location of the WS-Policy file, as described below:

- To specify one of the three pre-packaged WS-Policy files that are installed with WebLogic Server, use the `policy:` prefix and the name of one of the WS-Policy files (either `Auth.xml`, `Encrypt.xml`, or `Sign.xml`), as shown in the following example:

  ```
  @Policy(uri="policy:Encrypt.xml")
  ```

  If you use the pre-packaged WS-Policy files, you do not have to create one yourself or package it in an accessible location. For this reason, BEA recommends that you use the pre-packaged WS-Policy files whenever you can.

  See "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4 for information on the various types of message-level security provided by the pre-packaged WS-Policy files.

- To specify a user-created WS-Policy file, specify the path (relative to the location of the JWS file) along with its name, as shown in the following example:

  ```
  @Policy(uri="../policies/MyPolicy.xml")
  ```

  In the example, the `MyPolicy.xml` file is located in the `policies` sibling directory of the one that contains the JWS file.

- You can also specify that a WS-Policy file that is located in a shared J2EE library; this method is useful if you want to share the file amongst multiple Web Services packaged in different J2EE archives.

  In this case, it is assumed that the WS-Policy file is in the `META-INF/policies` or `WEB-INF/policies` directory of the shared J2EE library. Be sure, when you package the library, that you put the WS-Policy file in this directory.

  To specify a WS-Policy file in a shared J2EE library, use the `policy` prefix and then the name of the WS-policy file, as shown in the following example:

  ```
  @Policy(uri=”policy:MySharedPolicy.xml”)
  ```

See Creating Shared J2EE Libraries and Optional Packages for information on creating shared libraries and setting up your environment so the Web Service can find the shared WS-Policy files.

You can also set the following attributes of the `@Policy` annotation:

- `direction`—Specifies whether the policy file should be applied to the request (inbound) SOAP message, the response (outbound) SOAP message, or both. The default value if you do not specify this attribute is both. The `direction` attribute accepts the following values:
  - `Policy.Direction.both`
  - `Policy.Direction.inbound`
  - `Policy.Direction.outbound`
- `attachToWsdl`—Specifies whether the policy file should be attached to the WSDL file that describes the public contract of the Web Service. The default value of this attribute is `false`. Abstract WS-Policy files cannot be attached at build time, but rather, they are attached at deploy time when the missing information is filled in by WebLogic Server.

The following example shows how to use the `@Policy` and `@Policies` JWS annotations, with the relevant sections shown in bold:

```
package examples.webservices.security_jws;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.Policies;
import weblogic.jws.Policy;
import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.jws.soap.SOAPBinding;

/**
 *
 */
@WebService(name="SecureHelloWorldPortType",
            serviceName="SecureHelloWorldService",
            targetNamespace="http://www.bea.com")

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

@WLHttpTransport(contextPath="SecureHelloWorldService",
                 serviceUri="SecureHelloWorldService",
                 portName="SecureHelloWorldServicePort")
```

```
@Policies({
    @Policy(uri="policy:Auth.xml", direction=Policy.Direction.inbound),
    @Policy(uri="policy:Sign.xml"),
    @Policy(uri="policy:Encrypt.xml")})

public class SecureHelloWorldImpl {

  @WebMethod()
  public String sayHello(String s) {
    return "Hello " + s;
  }
}
```

In the example, three WS-Policy files are attached to the Web Service at the class level, which means that all three WS-Policy files are applied to all public operations of the Web Service. The specified WS-Policy files are those pre-packaged with WebLogic Server, which means that the developers do not need to create their own files or package them in the corresponding archive.

The `Auth.xml` file is applied to *only* the request (inbound) SOAP message, as specified by the `direction` attribute. This means that only the client application needs to provide a username token; when WebLogic Server responds to the invoke, it does not provide a username token. The `Sign.xml` WS-Policy file specifies that the body and WebLogic system headers of both the request and response SOAP message be digitally signed. The `Encrypt.xml` policy file specifies that the body of both the request and response SOAP messages be encrypted.

Updating a Client Application to Invoke a Message-Secured Web Service

When you update your Java code to invoke a message-secured Web Service, you must load a private key and digital certificate pair from the client's keystore and pass this information, along with a username and password for user authentication if so required by the WS-Policy, to the secure WebLogic Web Service being invoked.

If the WS-Policy file of the Web Service specifies that the SOAP request must be encrypted, then the Web Services client runtime automatically gets the server's certificate from the WS-Policy file that is attached to the WSDL of the service, and uses it for the encryption. If, however, the WS-Policy file is not attached to the WSDL, or the entire WSDL itself is not available, then the client application must use a client-side copy of the WS-Policy file; for details, see "Using a Client-Side Security WS-Policy File" on page 9-22.

The following example shows a Java client application that invokes the message-secured WebLogic Web Service described by the JWS file in "Updating the JWS File With the @SecurityRoles and @SecurityIdentity Annotations" on page 10-37. The client application takes five arguments:

- Client username for client authentication
- Client password for client authentication
- Client private key file
- Client digital certificate
- WSDL of the deployed Web Service

The security-specific code in the sample client application is shown in bold (and described after the example):

```
package examples.webservices.security_jws.client;

import weblogic.security.SSL.TrustManager;

import weblogic.xml.crypto.wss.provider.CredentialProvider;
import weblogic.xml.crypto.wss.WSSecurityContext;
import weblogic.wsee.security.bst.ClientBSTCredentialProvider;
import weblogic.wsee.security.unt.ClientUNTCredentialProvider;

import javax.xml.rpc.Stub;
import java.util.List;
import java.util.ArrayList;

import java.security.cert.X509Certificate;

/**
 *  Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */
public class SecureHelloWorldClient {
  public static void main(String[] args) throws Throwable {

    //username or password for the UsernameToken
    String username = args[0];
    String password = args[1];

    //client private key file
    String keyFile = args[2];

    //client certificate
    String clientCertFile = args[3];

    String wsdl = args[4];

    SecureHelloWorldService service = new SecureHelloWorldService_Impl(wsdl);

    SecureHelloWorldPortType port = service.getSecureHelloWorldServicePort();
```

```
    //create credential provider and set it to the Stub
    List credProviders = new ArrayList();

    //client side BinarySecurityToken credential provider -- x509
    CredentialProvider cp = new ClientBSTCredentialProvider(clientCertFile,
keyFile);
    credProviders.add(cp);

    //client side UsernameToken credential provider
    cp = new ClientUNTCredentialProvider(username, password);
    credProviders.add(cp);

    Stub stub = (Stub)port;
    stub._setProperty(WSSecurityContext.CREDENTIAL_PROVIDER_LIST,
credProviders);

    stub._setProperty(WSSecurityContext.TRUST_MANAGER,
      new TrustManager(){
         public boolean certificateCallback(X509Certificate[] chain, int
validateErr){
           return true;
         }
       } );

    String response = port.sayHello("World");
    System.out.println("response = " + response);
  }
}
```

The main points to note about the preceding code are:

- Import the WebLogic security `TrustManager` API:

  ```
  import weblogic.security.SSL.TrustManager;
  ```

- Import the following WebLogic Web Services security APIs to create the needed client-side credential providers, as specified by the WS-Policy files that are associated with the Web Service:

  ```
  import weblogic.xml.crypto.wss.provider.CredentialProvider;
  import weblogic.xml.crypto.wss.WSSecurityContext;
  import weblogic.wsee.security.bst.ClientBSTCredentialProvider;
  import weblogic.wsee.security.unt.ClientUNTCredentialProvider;
  ```

- Use the `ClientBSTCredentialProvider` WebLogic API to create a binary security token credential provider from the client's certificate and private key:

  ```
   CredentialProvider cp =
      new ClientBSTCredentialProvider(clientCertFile, keyFile);
  ```

- Use the `ClientUNTCredentialProvider` WebLogic API to create a username token from the client's username and password, which are also known by WebLogic Server:

  ```
  cp = new ClientUNTCredentialProvider(username, password);
  ```

- Use the `WSSecurityContext.CREDENTIAL_PROVIDER_LIST` property to pass a `List` object that contains the binary security and username tokens to the JAX-RPC Stub:

  ```
  stub._setProperty(WSSecurityContext.CREDENTIAL_PROVIDER_LIST,
  credProviders)
  ```

- Use the `weblogic.security.SSL.TrustManager` WebLogic security API to verify that the certificate used to encrypt the SOAP request is valid. The Web Services client runtime gets this certificate from the deployed WSDL of the Web Service, which in production situations is not automatically trusted, so the client application must ensure that it is okay before it uses it to encrypt the SOAP request:

  ```
  stub._setProperty(WSSecurityContext.TRUST_MANAGER,
        new TrustManager(){
          public boolean certificateCallback(X509Certificate[] chain, int
  validateErr){
             return true;
           }
         } );
  ```

Using Key Pairs Other Than the Out-Of-The-Box SSL Pair

In the simple message-level configuration procedure, documented in "Configuring Simple Message-Level Security: Main Steps" on page 10-8, it is assumed that the Web Services runtime uses the private key and X.509 certificate pair that is provided out-of-the-box with WebLogic Server; this same key pair is also used by the core security subsystem for SSL and is provided mostly for demonstration and testing purposes. In production environments, the Web Services runtime typically uses its own two private key and digital certificate pairs, one for signing and one for encrypting SOAP messages.

The following procedure describes the additional steps you must take to enable this use case.

1. Obtain two private key and digital certificate pairs to be used by the Web Services runtime. One of the pairs is used for digitally signing the SOAP message and the other for encrypting it.

   Although not required, BEA recommends that you obtain two pairs that will be used *only* by WebLogic Web Services. You must also ensure that both of the certificate's key usage matches what you are configuring them to do. For example, if you are specifying that a certificate be used for encryption, be sure that the certificate's key usage is specified as for encryption or is undefined. Otherwise, the Web Services security runtime will reject the certificate.

Warning: BEA requires that the key length be 1024 bits or larger.

You can use the Cert Gen utility or Sun Microsystem's `keytool` utility to perform this step. For development purposes, the `keytool` utility is the easiest way to get started.

See *Obtaining Private Keys and Digital Signatures*.

2. Create, if one does not currently exist, a custom identity keystore for WebLogic Server and load the private key and digital certificate pairs you obtained in the preceding step into the identity keystore.

   If you have already configured WebLogic Server for SSL, then you have already created a identity keystore which you can also use in this step.

   You can use WebLogic's `ImportPrivateKey` utility and Sun Microsystem's `keytool` utility to perform this step. For development purposes, the `keytool` utility is the easiest way to get started.

   See *Creating a Keystore and Loading Private Keys and Trusted Certificate Authorities Into the Keystore*.

3. Using the Administration Console, configure WebLogic Server to locate the keystore you created in the preceding step. If you are using a keystore that has already been configured for WebLogic Server, you do not need to perform this step.

   See *Configuring Keystores for Production*.

4. Using the Administration Console, create the default Web Service security configuration, which must be named `default_wss`. The default Web Service security configuration is used by *all* Web Services in the domain unless they have been explicitly programmed to use a different configuration.

   See Create a Web Service security configuration.

5. Update the default Web Services security configuration you created in the preceding step to use one of the private key and digital certificate pairs for digitally signing SOAP messages.

   See Create keystore used by SOAP message digital signatures. In the procedure, when you create the properties used to identify the keystore and key pair, enter the exact value for the Name of each property (such as `IntegrityKeyStore`, `IntegrityKeyStorePassword`, and so on), but enter the value that identifies your own previously-created keystore and key pair in the Value fields.

6. Similarly, update the default Web Services security configuration you created in a preceding step to use the second private key and digital certificate pair for encrypting SOAP messages.

   See Create keystore used by SOAP message encryption. In the procedure, when you create the properties used to identify the keystore and key pair, enter the exact value for the Name of each property (such as `ConfidentialityKeyStore`. `ConfidentialityKeyStorePassword`, and so on), but enter the value that identifies your own previously-created keystore and key pair in the Value fields.

Setting the SOAP Message Expiration

The `<MessageAge>` element in the WS-Policy file specifies whether SOAP messages resulting from an invoke of the Web Service associated with the WS-Policy file have an expiration. WebLogic Server rejects SOAP requests that have expired, based on their expiration time and the creation timestamp, which is included in the message. You can further configure expiration of messages by using the Administration Console to create and update the Web Services security configuration that is associated with the service.

The following bullets describe how the WebLogic Web Services runtime determines the expiration of a SOAP message for a particular Web Service:

- If the WS-Policy file associated with the Web Service does not include a `<MessageAge>` assertion, then the SOAP messages never expire.
- If the WS-Policy file includes a `<MessageAge>` assertion, but with no attributes, and the Web Service is not associated with a Web Service security configuration, then the expiration time is 60 seconds. If the Web Service is associated with a Web Service security configuration, then the expiration is the value of the **Validity Period** timestamp field of the associated Web Service security configuration (typically `default_wss`).

  The pre-packaged `Sign.xml` WS-Policy file falls into this category.
- If the WS-Policy file includes a `<MesageAge>` assertion with the `Age` attribute, then the expiration time is the value of the `Age` attribute. This value always overrides the value of the **Validity Period** field of any associated Web Service security configuration.

It is assumed in the following procedure that you have followed the steps in "Configuring Simple Message-Level Security: Main Steps" on page 10-8 and now want to set the message expiration.

To set the SOAP message expiration:

1. Ensure that the WS-Policy file associated with the Web Service includes a `<MessageAge>` assertion. The pre-packaged `Sign.xml` file includes one without any attributes.

If you add a `<MessageAge>` assertion to a custom WS-Policy file, and specify the `Age` attribute, then you are done; the expiration is the value of this attribute and cannot be overridden with the Administration Console. If you do not specify an attribute because you want the default of 60 seconds, then you are also done. If, however, you want to change this default value, go to the next step.

2. Using the Administration Console, create (if you have not already done so) the default Web Service security configuration, which must be named `default_wss`. The default Web Service security configuration is used by *all* Web Services in the domain unless they have been explicitly programmed to use a different configuration.

   See Create a Web Service security configuration.

3. Update the default Web Services security configuration you created in the preceding step to specify a different expiration:

   a. In the left pane of the Administration Console, select **domain > Web Service Security**.

   b. Select `default_wss` in the **Web Service Security Configuration** table.

   a. Select **Web Service Security > Timestamp**.

   b. Update the **Validity Period** field with the new expiration time, in seconds.

   c. Optionally update the other fields. Click the Help link in the top right corner for detailed information about these fields.

   d. Click **Save**.

Creating and Using a Custom WS-Policy File

Although WebLogic Server includes three pre-packaged WS-Policy files that typically satisfy the security needs of most programmers, you can also create and use your own WS-Policy file if you need additional configuration. For example, you must create your own WS-Policy file if you want to:

- Use SAML tokens for authentication
- Specify that particular parts of the body of a SOAP message be encrypted or digitally signed, rather than the entire body, which is what the `Encrypt.xml` and `Sign.xml` pre-packaged WS-Policy files do.

See “Using WS-Policy Files for Message-Level Security Configuration” on page 10-4 for general information about WS-Policy files and how they are used for message-level security configuration.

When you create a custom WS-Policy file, you can separate out the three main security categories (authentication, encryption, and signing) into three separate WS-Policy files, as do the pre-packaged files, or create a single WS-Policy file that contains all three categories. You can also create a custom WS-Policy file that changes just one category (such as authentication) and use the pre-packaged files for the other categories (`Sign.xml` and `Encrypt.xml`). In other words, you can mix and match the number and content of the WS-Policy files that you associate with a Web Service. In this case, however, you must always ensure yourself that the multiple files do not contradict each other.

The root element of your WS-Policy file must be `<Policy>` and include the following namespace declarations:

```
<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-
utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >
```

Defining Child Elements in a Custom WS-Policy File

Define the following child elements of the `<Policy>` root element in your WS-Policy file (see Appendix D, “Security Policy Assertion Reference,” for complete reference information about the elements):

- `<Identity>`—Specifies the tokens that are supported for authentication. The `<SupportedTokens>` element groups one or more `<SecurityTokens>` elements for each type of supported tokens for identity: username, X.509, or SAML. Use the `<Claims>` element to specify the type of confirmation for SAML tokens (sender-vouches or holder-of-key) and to specify use of password digests when using username tokens.

- `<Confidentiality>`—Specifies what parts of the SOAP message must be encrypted. Optional child elements include: `<KeyWrappingAlgorithm>` to specify the algorithm used to wrap symmetric keys, `<Target>` to specify the blocks of the SOAP message that are encrypted, and `<KeyInfo>` to specify the tokens used for encryption (in this release, only X.509 tokens are supported.)

- `<Integrity>`—Specifies what parts of the SOAP message must be digitally signed. Optional child elements include: `<SignatureAlgorithm>` to specify the algorithm used to sign the message, `<CanonicalizationAlgorithm>` to specify the algorithm used for canonicalization, `<Target>` to specify the blocks of the SOAP message that are digitally signed, and <SupportedTokens> to specify the types of tokens that can be used for signing (in this release, only X.509 tokens are supported.)

- <MessageAge>—Specifies the maximum age, in seconds, of a SOAP message.

See "Example of a Custom WS-Policy File" on page 10-22 for an example of a custom WS-Policy file used to specify SAML tokens for identity. Because the <Integrity> and <Confidentiality> elements do not include <KeyInfo> and <SupportedTokens> child elements, respectively, these sections of the file are abstract. The <Identity> element does include the SAML token, so the identity section is concrete.

You can also use the abstract pre-packaged WS-Policy files as templates to create your own custom files. See "Auth.xml" on page 10-5, "Sign.xml" on page 10-5, and "Encrypt.xml" on page 10-7.

Example of a Custom WS-Policy File

```
<<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-
utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >

  <wssp:Identity>
    <wssp:SupportedTokens>
      <wssp:SecurityToken
TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml-token-pro
file-1.0#SAMLAssertionID">
        <wssp:Claims>
          <wssp:ConfirmationMethod>sender-vouches</wssp:ConfirmationMethod>
        </wssp:Claims>
      </wssp:SecurityToken>
    </wssp:SupportedTokens>
  </wssp:Identity>

  <wssp:Integrity>

    <wssp:SignatureAlgorithm URI="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
    <wssp:CanonicalizationAlgorithm
         URI="http://www.w3.org/2001/10/xml-exc-c14n#"/>

    <wssp:Target>
      <wssp:DigestAlgorithm
```

```
          URI="http://www.w3.org/2000/09/xmldsig#sha1" />
     <wssp:MessageParts
          Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
          wsp:Body()
     </wssp:MessageParts>
   </wssp:Target>

   <wssp:Target>
     <wssp:DigestAlgorithm URI="http://www.w3.org/2000/09/xmldsig#sha1" />
     <wssp:MessageParts
          Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
          wls:SecurityHeader(Assertion)
     </wssp:MessageParts>
   </wssp:Target>

 </wssp:Integrity>

 <wssp:Confidentiality>

   <wssp:KeyWrappingAlgorithm URI="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>

   <wssp:Target>
     <wssp:EncryptionAlgorithm
          URI="http://www.w3.org/2001/04/xmlenc#tripledes-cbc"/>
     <wssp:MessageParts
          Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
           wls:SecurityHeader(Assertion)
     </wssp:MessageParts>
   </wssp:Target>

   <wssp:Target>
     <wssp:EncryptionAlgorithm
          URI="http://www.w3.org/2001/04/xmlenc#tripledes-cbc"/>
     <wssp:MessageParts
          Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
          wsp:Body()</wssp:MessageParts>
   </wssp:Target>

   <wssp:KeyInfo />
 </wssp:Confidentiality>

 <wssp:MessageAge/>

</wsp:Policy>
```

Associating WS-Policy Files at Runtime Using the Administration Console

The simple message-level configuration procedure, documented in "Configuring Simple Message-Level Security: Main Steps" on page 10-8, describes how to use the `@Policy` and `@Policies` JWS annotations in the JWS file that implements your Web Service to specify one or more WS-Policy files that are associated with your service. This of course implies that you must already know, at the time you program your Web Service, which WS-Policy files you want to associate with your Web Service and its operations. This might not always be possible, which is why you can also associate WS-Policy files at *runtime*, after the Web Service has been deployed, using the Administration Console.

You can use no `@Policy` or `@Policies` JWS annotations at all in your JWS file and associate WS-Policy files only at runtime using the Administration Console, or you can specify some WS-Policy files using the annotations and then associate additional ones at runtime. However, once you associate a WS-Policy file using the JWS annotations, you cannot change this association at runtime using the Administration Console.

At runtime, the Administration Console allows you to associate as many WS-Policy files as you want with a Web Service and its operations, even if the policy assertions in the files contradict each other or contradict the assertions in WS-Policy files associated with the JWS annotations. It is up to you to ensure that multiple associated WS-Policy files work together. If any contradictions do exist, WebLogic Server returns a runtime error when a client application invokes the Web Service operation.

See Associate a WS-Policy file with a Web Service for detailed instructions on using the Administration Console to associate a WS-Policy file at runtime.

Using Security Assertion Markup Language (SAML) Tokens For Identity

In the simple Web Services configuration procedure, described in "Configuring Simple Message-Level Security: Main Steps" on page 10-8, it is assumed that users use username tokens to authenticate themselves. Because WebLogic Server implements the Web Services Security: SAML Token Profile of the Web Services Security specification, users can also use SAML tokens in the SOAP messages to authenticate themselves when invoking a Web Service operation, as described in this section.

Use of SAML tokens works server-to-server. This means that the client application is running inside of a WebLogic Server instance and then invokes a Web Service running in another

WebLogic Server instance using SAML for identity. Because the client application is itself a Web Service, the Web Services security runtime takes care of all the SAML processing.

When you configure a Web Service to require SAML tokens for identity, you can specify one of the following confirmation methods:

- `sender-vouches`
- `holder-of-key`

See SAML Token Profile Support in WebLogic Web Services, as well as the Web Services Security: SAML Token Profile specification itself, for details about these confirmation methods.

Note: It is assumed in this section that you understand the basics of SAML and how it relates to core security in WebLogic Server. For general information, see Security Assertion Markup Language (SAML).

It is also assumed in the following procedure that you have followed the steps in "Configuring Simple Message-Level Security: Main Steps" on page 10-8 and now want to enable the additional use case of using SAML tokens, rather than usename tokens, for identity.

To use SAML tokens for identity, follow these steps:

1. Using the Administration Console, configure a SAML identity assertion and credential mapping provider. This step configures the *core* WebLogic Server security subsystem. For details, see:
   - Configuring a SAML Identity Assertion Provider
   - Configuring a SAML Credential Mapping Provider
2. Create a custom WS-Policy file that specifies that SAML should be used for identity. The exact syntax depends on the type of confirmation method you want to configure (`sender-vouches` or `holder-of-key`).

   To specify the sender-vouches confirmation method:

   - Create a `<SecurityToken>` child element of the `<Identity><SupportedTokens>` elements and set the `TokenType` attribute to a value that indicates SAML token usage.
   - Add a `<Claims><Confirmationmethod>` child element of `<SecurityToken>` and specify `sender-vouches`.

     For example:

```
<?xml version="1.0"?>
```

```
<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-w
ssecurity-utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >

  <wssp:Identity>
    <wssp:SupportedTokens>
      <wssp:SecurityToken

TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml
-token-profile-1.0#SAMLAssertionID">
        <wssp:Claims>

<wssp:ConfirmationMethod>sender-vouches</wssp:ConfirmationMethod>
        </wssp:Claims>
      </wssp:SecurityToken>
    </wssp:SupportedTokens>
  </wssp:Identity>

</wsp:Policy>
```

To specify the holder-of-key confirmation method:

– Create a `<SecurityToken>` child element of the `<Integrity><SupportedTokens>` elements and set the `TokenType` attribute to a value that indicates SAML token usage.

  The reason you put the SAML token in the `<Integrity>` assertion for the `holder-of-key` confirmation method is that the Web Service runtime must prove the integrity of the message, which is not required by `sender-vouches`.

– Add a `<Claims><Confirmationmethod>` child element of `<SecurityToken>` and specify `holder-of-key`.

  For example:

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-w
ssecurity-utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part">

  <wssp:Integrity>
    <wssp:SignatureAlgorithm
```

```
         URI="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
      <wssp:CanonicalizationAlgorithm
         URI="http://www.w3.org/2001/10/xml-exc-c14n#"/>

      <wssp:Target>
        <wssp:DigestAlgorithm
           URI="http://www.w3.org/2000/09/xmldsig#sha1" />
        <wssp:MessageParts
           Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
           wsp:Body()
        </wssp:MessageParts>
      </wssp:Target>

      <wssp:SupportedTokens>
        <wssp:SecurityToken
            IncludeInMessage="true"

TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml
-token-profile-1.0#SAMLAssertionID">
          <wssp:Claims>

<wssp:ConfirmationMethod>holder-of-key</wssp:ConfirmationMethod>
          </wssp:Claims>
        </wssp:SecurityToken>
      </wssp:SupportedTokens>
    </wssp:Integrity>

  </wsp:Policy>
```

See "Creating and Using a Custom WS-Policy File" on page 10-20 for additional information about creating your own WS-Policy file. See Appendix D, "Security Policy Assertion Reference," for reference information about the assertions.

3. Update the appropriate `@Policy` annotations in the JWS file that implements the Web Service to point to the custom WS-Policy file you created in the preceding step. For example, if you want invokes of *all* the operations of a Web Service to SAML for identity, specify the `@Policy` annotation at the class-level.

   You can mix and match the WS-Policy files that you associate with a Web Service, as long as they do not contradict each other. For example, you can create a simple `MyAuth.xml` file that contains only the `<Identity>` security assertion to specify use of SAML for identity and then associate it with the Web Service together with the pre-packaged `Encrypt.xml` and `Sign.xml` files. It is, however, up to you to ensure that multiple associated WS-Policy files do not contradict each other; if they do, you will either receive a runtime error or the Web Service might not behave as you expect.

4. Recompile and redeploy your Web Service as part of the normal iterative development process.

See "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2.

5. Create a client application that runs in a WebLogic Server instance to invoke the main Web Service using SAML as identity. See "Invoking a Message-Secured Web Service From A Client Running in a WebLogic Server Instance" on page 10-31 for details.

Using X.509 Certificate Tokens for Identity

In the simple Web Services configuration procedure, described in "Configuring Simple Message-Level Security: Main Steps" on page 10-8, it is assumed that users use username tokens to authenticate themselves. Because WebLogic Server implements the Web Services Security: X.509 Certificate Token Profile of the Web Services Security specification, users can also use X.509 certificates to authenticate themselves when invoking a Web Service operation, as described in this section.

Note: It is assumed in the following procedure that you have followed the steps in "Configuring Simple Message-Level Security: Main Steps" on page 10-8 and now want to enable the additional use case of using X.509 certificates for identity.

1. Using the Administration Console, create (if you have not already done so) the default Web Service security configuration, which must be named `default_wss`. The default Web Service security configuration is used by *all* Web Services in the domain unless they have been explicitly programmed to use a different configuration.

   See Create a Web Service security configuration.

2. Update the default Web Services security configuration you created in the preceding step to specify that X.509 certificates should be used for identity. See Use X.509 certificates to establish identity.

3. Create a custom WS-Policy file that specifies that X.509 certificates should be used for identity.

   In particular, you must set the `TokenType` attribute of the `<SecurityToken>` child element of the `<Identity><SupportedTokens>` elements to `#x509Token`, as shown in the following simple example:

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"
  >

  <wssp:Identity>
```

```
    <wssp:SupportedTokens>
      <wssp:SecurityToken TokenType="#X509Token" />
    </wssp:SupportedTokens>

  </wssp:Identity>

</wsp:Policy>
```

See “Creating and Using a Custom WS-Policy File” on page 10-20 for additional information about creating your own WS-Policy file.

4. Update the appropriate `@Policy` annotations in your JWS file to point to the custom WS-Policy file you created in the preceding step. For example, if you want invokes of *all* the operations of a Web Service to use X.509 for identity, specify the `@Policy` annotation at the class-level.

   You can mix and match the WS-Policy files that you associate with a Web Service, as long as they do not contradict each other. For example, you can create a simple `MyAuth.xml` file that contains only the `<Identity>` security assertion to specify use of X.509 certificates for identity and then associate it with the Web Service together with the pre-packaged `Encrypt.xml` and `Sign.xml` files. It is, however, up to you to ensure that multiple associated WS-Policy files do not contradict each other. If they do, you will receive a runtime error.

5. Recompile and redeploy your Web Service as part of the normal iterative development process.

   See “Iterative Development of WebLogic Web Services Starting From Java: Main Steps” on page 4-2.

6. You can use the same client application, described in “Updating a Client Application to Invoke a Message-Secured Web Service” on page 10-14, when using X.509 for identity. The only optional update is to remove the creation of the username token, which is not needed for this use case. The code to remove is:

```
//client side UsernameToken credential provider
cp = new ClientUNTCredentialProvider(username, password);
credProviders.add(cp);
```

Using a Password Digest In the SOAP Message Rather Than Plaintext

By default, the WebLogic Web Services security runtime uses cleartext passwords, rather than the password digest, in the SOAP messages resulting from an invoke of a message-secured Web

Service. The following procedure shows how to change this default behavior so that the SOAP messages use the password digest.

It is assumed in the following procedure that you have followed the steps in “Configuring Simple Message-Level Security: Main Steps” on page 10-8 and now want to specify that all SOAP messages use password digest rather than cleartext.

1. Using the Administration Console, create (if you have not already done so) the default Web Service security configuration, which must be named `default_wss`. The default Web Service security configuration is used by *all* Web Services in the domain unless they have been explicitly programmed to use a different configuration.

   Warning: If you have created Web Services security configuration in addition to the default one (`default_wss`), each configuration should specify the *same* password digest use. Inconsistent password digest use in different Web Service security configurations will result in a runtime error.

   See Create a Web Service security configuration.

2. Update the default Web Services security configuration you created in the preceding step to specify that password digests should be used in SOAP messages. See Use a password digest in SOAP messages.

3. Update the default WebLogic Authentication provider of the core WebLogic Server security to store cleartext passwords rather than the digest. See Configure Authentication and Identity Assertion providers.

4. If you are *not* using the pre-packaged `Auth.xml` file and have instead created a custom WS-Policy file and have explicitly specified a username token with the `<Identity><SupportedTokens><SecurityToken>` elements, then you must add a `<Claims><UsePassword>` child element as shown below:

```
<wssp:Identity>

  <wssp:SupportedTokens>

   <wssp:SecurityToken TokenType="#UsernameToken">
    <wssp:Claims>
     <wssp:UsePassword

Type="http://www.docs.oasis-open.org/wss/2004/01/oasis-200401-wss-usern
ame-token-profile-1.0#PasswordDigest" />

    </wssp:Claims>
   </wssp:SecurityToken>

  </wssp:SupportedTokens>
```

```
</wssp:Identity>
```

If you are using the pre-packaged `Auth.xml` file to configure authentication, you do not need to perform this step.

See “Creating and Using a Custom WS-Policy File” on page 10-20 for additional information about creating your own WS-Policy file.

5. If you created a custom WS-Policy file, update the appropriate `@Policy` annotations in your JWS file to point to it. See “Updating the JWS File with @Policy and @Policies Annotations” on page 10-11.

6. Recompile and redeploy your Web Service as part of the normal iterative development process.

   See “Iterative Development of WebLogic Web Services Starting From Java: Main Steps” on page 4-2.

Invoking a Message-Secured Web Service From A Client Running in a WebLogic Server Instance

In the simple Web Services configuration procedure, described in “Configuring Simple Message-Level Security: Main Steps” on page 10-8, it is assumed that a *stand-alone* client application invokes the message-secured Web Service. Sometimes, however, the client is itself running in a WebLogic Server instance, as part of an EJB, servlet, or another Web Service. In this case, you can use the core WebLogic Server security framework to configure the credential providers and trust manager so that your EJB, servlet, or JWS code contains only the simple invoke of the secured operation and no other security-related API usage. The following procedure describes the high level steps you must perform to make use of the core WebLogic Server security framework in this use case.

1. In your EJB, servlet, or JWS code, invoke the Web Service operation as if it were *not* configured for message-level security. Specifically, do not create a `CredentialProvider` object that contains username or X.509 tokens, and do not use the `TrustManager` core security API to validate the certificate from the WebLogic Server hosting the secure Web Service. The reason you should not use these APIs in your client code is that the Web Services runtime will perform this work for you.

2. Using the Administration Console, configure the required credential mapping providers of the core security of the WebLogic Server instance that hosts your client application. The list of required credential mapper providers depends on the WS-Policy file that is attached

to the Web Service you are invoking. Typically, you must configure the credential mapper providers for both username/password and X.509 certificates. See Configuring a WebLogic Credential Mapping Provider.

Note: WebLogic Server includes a credential mapping provider for username/passwords and X.509. However, only username/password is configured by default.

3. Using the Administration Console, create the actual credential mappings in the credential mapping providers you configured in the preceding step. You must map the user principal, associated with the client running in the server, to the credentials that are valid for the Web Service you are invoking. See Configuring a WebLogic Credential Mapping Provider.

4. Using the Administration Console, configure the core WebLogic Server security framework to trust the X.509 certificate of the invoked Web Service. See Configuring the Credential Lookup and Validation Framework.

You are not required to configure the core WebLogic Server security framework, as described in this procedure, if your client application does not want to use the out-of-the-box credential provider and trust manager. Rather, you can override all of this configuration by using the same APIs in your EJB, servlet, and JWS code as in the stand-alone Java code described in "Updating a Client Application to Invoke a Message-Secured Web Service" on page 10-14. However, using the core security framework standardizes the WebLogic Server configuration and simplifies the Java code of the client application that invokes the Web Service.

Associating a Web Service with a Security Configuration Other Than the Default

Many of the use cases in this topic require you to use the Administration Console to create the default Web Service security configuration called `default_wss`. After you create this configuration, it is applied to all Web Services that either do *not* use the `@weblogic.jws.security.WssConfiguration` JWS annotation or specify the annotation with no attribute.

There are some cases, however, in which you might want to associate a Web Service with a security configuration *other* than the default; such use cases include specifying different timestamp values for different services.

To associate a Web Service with a security configuration other than the default:

1. Create a Web Service security configuration with a name that is *not* `default_wss`.

2. Update your JWS file, adding the `@WssConfiguration` annotation to specify the name of this security configuration. See “weblogic.jws.security.WssConfiguration” on page B-51 for additional information and an example.
3. Recompile and redeploy your Web Service as part of the normal iterative development process.

   See “Iterative Development of WebLogic Web Services Starting From Java: Main Steps” on page 4-2.

Warning: All Web Services security configurations are required to specify the *same* password digest use. Inconsistent password digest use in different Web Service security configurations will result in a runtime error.

Configuring Transport-Level Security

Transport-level security refers to securing the connection between a client application and a Web Service with Secure Sockets Layer (SSL).

See Secure Sockets Layer (SSL) for general information about SSL and the implementations included in WebLogic Server.

To configure transport-level Web Services security:

1. Configure SSL for the core WebLogic Server security subsystem.

   You can configure one-way SSL (the default described in this section) where WebLogic Server is required to present a certificate to the client application, or two-way SSL where both the client applications and WebLogic server present certificates to each other.

   To configure two-way or one-way SSL for the core WebLogic Server security subsystem, see Configuring SSL.
2. Optionally specify that your Web Service can be invoked using HTTPS by default by using one of the following mechanisms:
   - When programming the JWS file that implements your Web Service, specify the `@weblogic.jws.WLHttpsTransport` annotation. See “weblogic.jws.WLHttpsTransport” on page B-43.
   - When building the Web Service, specify the `<WLHttpsTransport>` child element of the `jwsc` Ant task. See “jwsc” on page A-13.
3. When you run the client application that invokes the Web Service, specify certain properties to indicate the SSL implementation that your application should use. In particular:

– To specify the Certicom SSL implementation, use the following properties

```
-Djava.protocol.handler.pkgs=weblogic.net
-Dweblogic.security.SSL.trustedCAKeyStore=trustStore
```

where `trustStore` specifies the name of the client-side truststore that contains the list of trusted certificates (one of which should be the server's certificate). To disable host name verification, also specify the following property:

```
-Dweblogic.security.SSL.ignoreHostnameVerification=true
```

– To specify Sun's SSL implementation, use the following properties:

```
-Djavax.net.ssl.trustStore=trustStore
```

where `trustStore` specifies the name of the client-side truststore that contains the list of trusted certificates (one of which should be the server's certificate).   To disable host name verification, also specify the following property:

```
-Dweblogic.wsee.client.ssl.stricthostchecking=false
```

See "Configuring Two-Way SSL for a Client Application" on page 10-34 for details about two-way SSL.

Configuring Two-Way SSL for a Client Application

If you configured two-way SSL for WebLogic Server, the client application must present a certificate to WebLogic Server, in addition to WebLogic Server presenting a certificate to the client application as required by one-way SSL. You must also follow these requirements:

- The SSL package of J2SE requires that the password of the client's private key must be the same as the password of the client's keystore. For this reason, the client keystore can include only *one* private key and X.509 certificate pair.
- Create a *truststore* which contains the certificates that the client trusts; the client application uses this truststore to validate the certificate it receives from WebLogic Server. Because of the J2SE password requirement described in the preceding bullet item, this truststore must be different from the keystore that contains the key pair that the client presents to the server.
- Configure the core WebLogic Server's security subsystem, mapping the client's X.509 certificate to a user. See Configuring a User Name Mapper.
- When you run the client application that invokes the Web Service, specify the following properties:
  - `-Djavax.net.ssl.trustStore=trustStore`

– `-Djavax.net.ssl.trustStorePassword=`*`trustStorePassword`*

where *`trustStore`* specifies the name of the client-side truststore that contains the list of trusted certificates (one of which should be the server's certificate) and *`trustStorePassword`* specifies the truststore's password.

The preceding properties are in addition to the standard properties you must set to specify the client-side keystore:

– `-Djavax.net.ssl.keyStore=`*`keyStore`*

– `-Djavax.net.ssl.keyStorePassword=`*`keyStorePassword`*

Additional Web Services SSL Examples

The dev2dev CodeShare is a community of developers that share ideas, code and best practices related to BEA technologies. The site includes code examples for a variety of BEA technologies, including using SSL with Web Services.

To view and download the SSL Web Services code examples on the dev2dev site, go to the main Projects page and click on **Web Services** in the *By Technology* column.

Configuring Access Control Security: Main Steps

Access control security refers to configuring the Web Service to control the users who are allowed to access it, and then coding your client application to authenticate itself, using HTTP or username tokens, to the Web Service when the client invokes one of its operations.

Because WebLogic Web Services are implemented with either a stateless session EJB or a Java class, you can secure the Web Service by securing these components in the standard J2EE way. See *Secure WebLogic Resources*.

If your Web Service is implemented with an EJB, you can also use the following Web Service-specific JWS annotations in your JWS file:

- `@weblogic.jws.security.SecurityRoles`—Specifies the roles that are allowed to access the entire Web Service or selected operations.
- `@weblogic.jws.security.SecurityIdentity`—Specifies the identity assumed by the Web Service when it is invoked.

See "Should You Implement a Stateless Session EJB?" on page 5-16 for instructions on explicitly implementing an EJB, which is required to use these two annotations.

The following procedure describes the high-level steps; later sections in the chapter describe the steps in more detail.

Note: It is assumed in the following procedure that you have already created a JWS file that implements a WebLogic Web Service and you want to update it with access control security. It is also assumed that you use Ant build scripts to iteratively develop your Web Service and that you have a working `build.xml` file that you can update with new information. Finally, it is assumed that you have a client application that invokes the non-secured Web Service. If these assumptions are not true, see:

- Chapter 5, "Programming the JWS File"
- Chapter 4, "Iterative Development of WebLogic Web Services"
- Chapter 9, "Invoking Web Services"

1. Update your JWS file, adding the `@SecurityRoles` or `@SecurityIdentity` annotations at the class or method level.

   See "Updating the JWS File With the @SecurityRoles and @SecurityIdentity Annotations" on page 10-37.

2. If you have not already done so, ensure that your JWS file explicitly implements an EJB; see "Should You Implement a Stateless Session EJB?" on page 5-16 for instructions.

3. Optionally specify that your Web Service can be invoked using HTTPS by default by using one of the following mechanisms:

   – When programming the JWS file that implements your Web Service, specify the `@weblogic.jws.WLHttpsTransport` annotation. See "weblogic.jws.WLHttpsTransport" on page B-43.

   – When building the Web Service, specify the `<WLHttpsTransport>` child element of the `jwsc` Ant task. See "jwsc" on page A-13.

4. Recompile and redeploy your Web Service as part of the normal iterative development process.

   See "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2.

5. Using the Administration Console, create the role and users that map to the role.

   See Users, Groups, and Security Roles at http://e-docs.bea.com/wls/docs90/secwlres/secroles.html.

6. Update your client application to authenticate itself when invoking an access-secured WebLogic Web Service.

   There are a variety of ways you can perform this step:

   – Using message-level security, as described in "Updating a Client Application to Invoke a Message-Secured Web Service" on page 10-14

   – Using 2-way transport security, as described in "Configuring Two-Way SSL for a Client Application" on page 10-34

   – Using simple JAX-RPC properties, as described in "Updating a Client Application to Authenticate Itself Using JAX-RPC Properties" on page 10-39

Updating the JWS File With the @SecurityRoles and @SecurityIdentity Annotations

Note: The `@weblogic.security.jws.SecurityRoles` and `@weblogic.security.jws.SecurityIdentity` JWS annotations are deprecated in this release.

Use the WebLogic-specific `@weblogic.security.jws.SecurityRoles` JWS annotation in your JWS file to specify the roles that are allowed to invoke the operations of a Web Service. Use the `@weblogic.security.jws.SecurityIdentity` annotation to specify the identity that the Web Service assumes when it is invoked.

You can set the `@SecurityRoles` annotation at both the class level or at the method level. When set at the class-level, the roles apply to all public operations. You can add additional roles to a particular operation by specifying the annotation at the method level.

The `@SecurityRoles` annotation has two attributes:

- `rolesAllowed`—Specifies the roles that are allowed to access the operations.

  This annotation is the equivalent of the `<method-permission>` element in the `ejb-jar.xml` deployment descriptor of the stateless session EJB that implements the Web Service.

- `rolesReference`—Specifies a list of roles referenced by the Web Service.

  This annotation is the equivalent of the `<security-role-ref>` element in the `ejb-jar.xml` deployment descriptor of the stateless session EJB that implements the Web Service.

You can set the `@SecurityIdentity` annotation only at the class-level and it has just one attribute, `value`, which specifies the role which the Web Service assumes when it is invoked. The role must map to a user or group in the WebLogic Server security realm.

The following example shows how to use the `@SecurityRoles` and `@SecurityIdentity` annotations in a JWS file, with the relevant sections shown in bold:

```
package examples.webservices.security_roles;

import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

import weblogic.ejbgen.Session;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;

import weblogic.jws.WLHttpTransport;
import weblogic.jws.security.SecurityRoles;
import weblogic.jws.security.SecurityIdentity;

@Session(ejbName="SecurityRolesEJB")

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

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

@WLHttpTransport(contextPath="security", serviceUri="SecurityRolesService",
                 portName="SecurityRolesPort")

// Specifies the roles who can invoke the entire Web Service

@SecurityRoles(rolesAllowed="Admin")
@SecurityIdentity( value="Admin")

/**
 * This JWS file forms the basis of simple Java-class implemented WebLogic
 * Web Service with a single operation: sayHello
 *
 */

public class SecurityRolesImpl implements SessionBean {

  @WebMethod()
  public String sayHello(String message) {
    System.out.println("sayHello:" + message);
```

```
    return "Here is the message: '" + message + "'";
  }
  // Standard EJB methods.  Typically there's no need to override the methods.

  public void ejbCreate() {}
  public void ejbActivate() {}
  public void ejbRemove() {}
  public void ejbPassivate() {}
  public void setSessionContext(SessionContext sc) {}
}
```

Updating a Client Application to Authenticate Itself Using JAX-RPC Properties

When you write a JAX-RPC client application that invokes a Web Service, you use the following two properties to send a user name and password to the service so that the client can authenticate itself:

- `javax.xml.rpc.security.auth.username`
- `javax.xml.rpc.security.auth.password`

The following example, taken from the JAX-RPC specification, shows how to use these properties when using the `javax.xml.rpc.Stub` interfaces to invoke a secure Web Service:

```
StockQuoteProviderStub sqp = // ... get the Stub;
sqp._setProperty ("javax.xml.rpc.security.auth.username", "juliet");
sqp._setProperty ("javax.xml.rpc.security.auth.password", "mypassword");
float quote sqp.getLastTradePrice("BEAS");
```

For additional information on writing a client application using JAX-RPC to invoke a secure Web Service, see http://java.sun.com/xml/jaxrpc/index.html.

Administering Web Services

The following sections describe how to administer WebLogic Web Services:

- "Overview of WebLogic Web Services Administration Tasks" on page 11-1
- "Administration Tools" on page 11-2
- "Using the Administration Console" on page 11-3
- "Using the WebLogic Scripting Tool" on page 11-7
- "Using WebLogic Ant Tasks" on page 11-8
- "Using the Java Management Extensions (JMX)" on page 11-8
- "Using the J2EE Deployment API" on page 11-9

Overview of WebLogic Web Services Administration Tasks

When you use the `jwsc` Ant task to compile and package a WebLogic Web Service, the task packages it as part of an Enterprise Application. The Web Service itself is packaged inside the Enterprise application as either an EJB JAR or a Web application WAR file, depending on the Web Service implementation. Therefore, basic administration of Web Services is very similar to basic administration of standard J2EE applications and modules. These standard tasks include:

- Installing the Enterprise application that contains the Web Service.
- Starting and stopping the deployed Enterprise application.

- Configuring the Enterprise application and the archive file which implements the actual Web Service. You can configure general characteristics of the Enterprise application, such as the deployment order, or module-specific characteristics, such as session time-out for Web applications or transaction type for EJBs.
- Creating and updating the Enterprise application's deployment plan.
- Monitoring the Enterprise application.
- Testing the Enterprise application.

The following administrative tasks are specific to Web Services:

- Configuring the JMS resources used by Web Service reliable messaging and JMS transport
- Configuring the WS-Policy files associated with a Web Service endpoint or its operations.

  Warning: If you used the `@Policy` annotation in your Web Service to specify an associated WS-Policy file at the time you programmed the JWS file, you cannot change this association at run-time using the Administration Console or other administrative tools. You can only associate a *new* WS-Policy file, or disassociate one you added at run-time.

- Viewing the SOAP handlers associated with the Web Service.
- Viewing the WSDL of the Web Service.
- Creating a Web Service security configuration.

Administration Tools

There are a variety of ways to administer J2EE modules and applications that run on WebLogic Server, including Web Services; use the tool that best fits your needs:

- Using the Administration Console
- Using the WebLogic Scripting Tool
- Using WebLogic Ant Tasks
- Using the Java Management Extensions (JMX)
- Using the J2EE Deployment API

Using the Administration Console

The BEA WebLogic Server Administration Console is a Web browser-based, graphical user interface you use to manage a WebLogic Server domain, one or more WebLogic Server instances, clusters, and applications, including Web Services, that are deployed to the server or cluster.

One instance of WebLogic Server in each domain is configured as an Administration Server. The Administration Server provides a central point for managing a WebLogic Server domain. All other WebLogic Server instances in a domain are called Managed Servers. In a domain with only a single WebLogic Server instance, that server functions both as Administration Server and Managed Server. The Administration Server hosts the Administration Console, which is a Web Application accessible from any supported Web browser with network access to the Administration Server.

You can use the System Administration Console to:

- Install an Enterprise application.
- Start and stop a deployed Enterprise application.
- Configure an Enterprise application.
- Configure Web applications.
- Configure EJBs.
- Create a deployment plan.
- Update a deployment plan.
- Test the modules in an Enterprise application.
- Configure JMS resources for Web Service reliable messaging.
- Associate the WS-Policy file with a Web Service.
- View the SOAP message handlers of a Web Service.
- View the WSDL of a Web Service.
- Create a Web Service security configuration

Invoking the Administration Console

To invoke the Administration Console in your browser, enter the following URL:

```
http://host:port/console
```

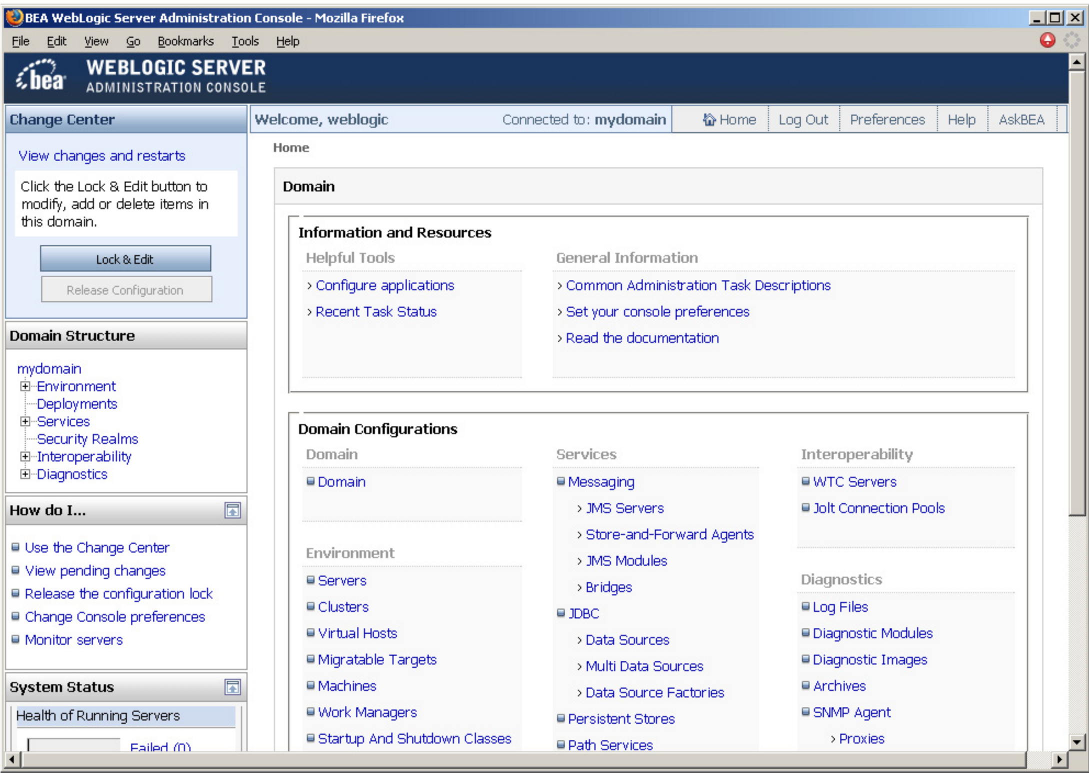
where

- *host* refers to the computer on which the Administration Server is running.
- *port* refers to the port number where the Administration Server is listening for connection requests. The default port number for the Administration server is 7001.

Click the **Help** button, located at the top right corner of the Administration Console, to invoke the Online Help for detailed instructions on using the Administration Console.

The following figure shows the main Administration Console window.

Figure 11-1 WebLogic Server Administration Console Main Window



How Web Services Are Displayed In the Administration Console

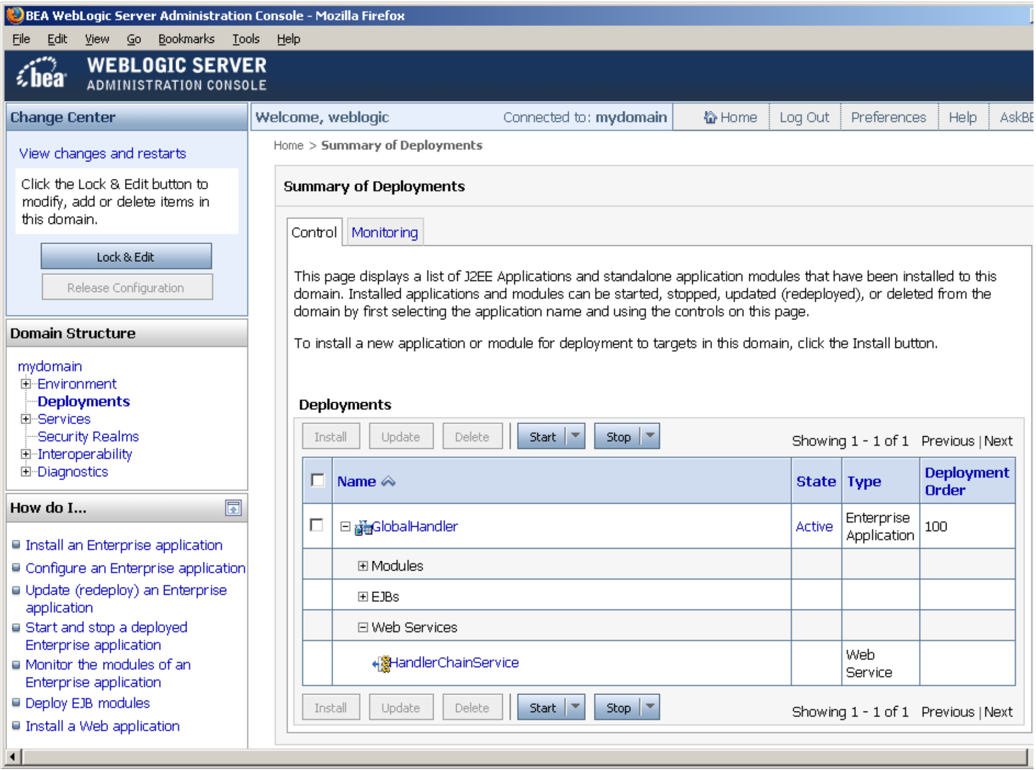
Web Services are typically deployed to WebLogic Server as part of an Enterprise Application. The Enterprise Application can be either archived as an EAR, or be in exploded directory format. The Web Service itself is packaged as either a Web Application or an EJB, depending on its implementation. The Web Service can be in archived format (WAR or JAR file, respectively) or as an exploded directory.

It is not required that a Web Service be installed as part of an Enterprise application; it can be installed as just the Web Application or EJB. However, BEA recommends that users install the Web Service as part of an Enterprise application. The WebLogic Ant task used to create a Web Service, `jwsc`, always packages the generated Web Service into an Enterprise application.

To view and update the Web Service-specific configuration information about a Web Service using the Administration Console, click on the Deployments node in the left pane and, in the Deployments table that appears in the right pane, find 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 to view or update its configuration.

The following figure shows how the `HandlerChainService` Web Service, packaged inside the `GlobalHandler` Enterprise application, is displayed in the **Deployments** table of the Administration Console.

Figure 11-2 Web Service Displayed in Deployments Table of Administration Console



Creating a Web Services Security Configuration

When a deployed WebLogic Web Service has been configured to use message-level security (encryption and digital signatures, as described by the WS-Security specification), the Web Services runtime determines whether a Web Service security configuration is also associated with the service. This security configuration specifies information such as whether to use an X.509 certificate for identity, whether to use password digests, the keystore to be used for encryption, and so on. A single security configuration can be associated with many Web Services.

Because Web Services security configurations are domain-wide, you create them from the ***domainName* > WebService Security** tab of the Administration Console, rather than the **Deployments** tab. The following figure shows the location of this tab.

Figure 11-3 Web Service Security Configuration in Administration Console

Using the WebLogic Scripting Tool

The WebLogic Scripting Tool (WLST) is a command-line scripting interface that you can use to interact with and configure WebLogic Server domains and instances, as well as deploy J2EE modules and applications (including Web Services) to a particular WebLogic Server instance. Using WLST, system administrators and operators can initiate, manage, and persist WebLogic Server configuration changes.

Typically, the types of WLST commands you use to administer Web Services fall under the Deployment category.

For more information on using WLST, see WebLogic Scripting Tool at http://e-docs.bea.com/wls/docs90/config_scripting/index.html.

Using WebLogic Ant Tasks

WebLogic Server includes a variety of Ant tasks that you can use to centralize many of the configuration and administrative tasks into a single Ant build script. These Ant tasks can:

- Create, start, and configure a new WebLogic Server domain, using the `wlserver` and `wlconfig` Ant tasks.
- Deploy a compiled application to the newly-created domain, using the `wldeploy` Ant task.

See Using Ant Tasks to Configure a WebLogic Server Domain and wldeploy Ant Task Reference for specific information about the non-Web Services related WebLogic Ant tasks.

Using the Java Management Extensions (JMX)

A managed bean (MBean) is a Java bean that provides a Java Management Extensions (JMX) interface. JMX is the J2EE solution for monitoring and managing resources on a network. Like SNMP and other management standards, JMX is a public specification and many vendors of commonly used monitoring products support it.

BEA WebLogic Server provides a set of MBeans that you can use to configure, monitor, and manage WebLogic Server resources through JMX. WebLogic Web Services also have their own set of MBeans that you can use to perform some Web Service administrative tasks.

There are two types of MBeans: runtime (for read-only monitoring information) and configuration (for configuring the Web Service after it has been deployed).

The configuration Web Services MBeans are:

- `WebserviceSecurityConfigurationMBean`
- `WebserviceCredentialProviderMBean`
- `WebserviceSecurityMBean`
- `WebserviceSecurityTokenMBean`
- `WebserviceTimestampMBean`
- `WebserviceTokenHandlerMBean`

The runtime Web Services MBeans are:

- `WseeRuntimeMBean`
- `WseeHandlerRuntimeMBean`

- `WseePortRuntimeMBean`
- `WseeOperationRuntimeMBean`
- `WseePolicyRuntimeMBean`

For more information on JMX, see:

- Understanding WebLogic Server MBeans
- Accessing WebLogic Server MBeans with JMX
- Managing a Domain's Configuration with JMX
- WebLogic Server MBean Reference.

Using the J2EE Deployment API

In J2EE 1.4, the J2EE Application Deployment specification (JSR-88) defines a standard API that you can use to configure an application for deployment to a target application server environment.

The specification describes the J2EE 1.4 Deployment architecture, which in turn defines the contracts that enable tools or application programmers to configure and deploy applications on any J2EE platform product. The contracts define a uniform model between tools and J2EE platform products for application deployment configuration and deployment. The Deployment architecture makes it easier to deploy applications: Deployers do not have to learn all the features of many different J2EE deployment tools in order to deploy an application on many different J2EE platform products.

See Deploying Applications to WebLogic Server for more information.

Publishing and Finding Web Services Using UDDI

The following sections provide information about publishing and finding Web Services through the UDDI registry:

- "Overview of UDDI" on page 12-1
- "WebLogic Server UDDI Features" on page 12-4
- "UDDI 2.0 Server" on page 12-5
- "UDDI Directory Explorer" on page 12-20
- "UDDI Client API" on page 12-20
- "Pluggable tModel" on page 12-21

Overview of UDDI

UDDI stands for Universal Description, Discovery, and Integration. The UDDI Project is an industry initiative aims to enable businesses to quickly, easily, and dynamically find and carry out transactions with one another.

A populated UDDI registry contains cataloged information about businesses; the services that they offer; and communication standards and interfaces they use to conduct transactions.

Built on the Simple Object Access Protocol (SOAP) data communication standard, UDDI creates a global, platform-independent, open architecture space that will benefit businesses.

The UDDI registry can be broadly divided into two categories:

- UDDI and Web Services
- UDDI and Business Registry

For details about the UDDI data structure, see "UDDI Data Structure" on page 12-3.

UDDI and Web Services

The owners of Web Services publish them to the UDDI registry. Once published, the UDDI registry maintains pointers to the Web Service description and to the service.

The UDDI allows clients to search this registry, find the intended service, and retrieve its details. These details include the service invocation point as well as other information to help identify the service and its functionality.

Web Service capabilities are exposed through a programming interface, and usually explained through Web Services Description Language (WSDL). In a typical publish-and-inquire scenario, the provider publishes its business; registers a service under it; and defines a binding template with technical information on its Web Service. The binding template also holds reference to one or several *tModels*, which represent abstract interfaces implemented by the Web Service. The tModels might have been uniquely published by the provider, with information on the interfaces and URL references to the WSDL document.

A typical client inquiry may have one of two objectives:

- To find an implementation of a known interface. In other words, the client has a tModel ID and seeks binding templates referencing that tModel.
- To find the updated value of the invocation point (that is., access point) of a known binding template ID.

UDDI and Business Registry

As a Business Registry solution, UDDI enables companies to advertise the business products and services they provide, as well as how they conduct business transactions on the Web. This use of UDDI complements business-to-business (B2B) electronic commerce.

The minimum required information to publish a business is a single business name. Once completed, a full description of a business entity may contain a wealth of information, all of which helps to advertise the business entity and its products and services in a precise and accessible manner.

A Business Registry can contain:

- **Business Identification**—Multiple names and descriptions of the business, comprehensive contact information, and standard business identifiers such as a tax identifier.
- **Categories**—Standard categorization information (for example a D-U-N-S business category number).
- **Service Description**—Multiple names and descriptions of a service. As a container for service information, companies can advertise numerous services, while clearly displaying the ownership of services. The `bindingTemplate` information describes how to access the service.
- **Standards Compliance**—In some cases it is important to specify compliance with standards. These standards might display detailed technical requirements on how to use the service.
- **Custom Categories**—It is possible to publish proprietary specifications (tModels) that identify or categorize businesses or services.

UDDI Data Structure

The data structure within UDDI consists of four constructions: a `businessEntity` structure, a `businessService` structure, a `bindingTemplate` structure and a `tModel` structure.

The following table outlines the difference between these constructions when used for Web Service or Business Registry applications.

Table 12-1 UDDI Data Structure

Data Structure	Web Service	Business Registry
businessEntity	Represents a Web Service provider: • Company name • Contact detail • Other business information	Represents a company, a division or a department within a company: • Company name(s) • Contact details • Identifiers and Categories
businessService	A logical group of one or several Web Services. API(s) with a single name stored as a child element, contained by the business entity named above.	A group of services may reside in a single `businessEntity`. • Multiple names and descriptions • Categories • Indicators of compliancy with standards
bindingTemplate	A single Web Service. Technical information needed by client applications to bind and interact with the target Web Service. Contains access point (that is, the URI to invoke a Web Service).	Further instances of standards conformity. Access points for the service in form of URLs, phone numbers, email addresses, fax numbers or other similar address types.
tModel	Represents a technical specification; typically a specifications pointer, or metadata about a specification document, including a name and a URL pointing to the actual specifications. In the context of Web Services, the actual specifications document is presented in the form of a WSDL file.	Represents a standard or technical specification, either well established or registered by a user for specific use.

WebLogic Server UDDI Features

WebLogic Server provides the following UDDI features:

- UDDI 2.0 Server
- UDDI Directory Explorer

- UDDI Client API
- Pluggable tModel

UDDI 2.0 Server

The UDDI 2.0 Server is part of WebLogic Server and is started automatically when WebLogic Server is started. The UDDI Server implements the UDDI 2.0 server specification at http://www.uddi.org/specification.html.

Configuring the UDDI 2.0 Server

To configure the UDDI 2.0 Server:

1. Stop WebLogic Server.
2. Update the `uddi.properties` file, located in the *`WL_HOME`*`/server/lib` directory, where *`WL_HOME`* refers to the main WebLogic Server installation directory.

   Warning: If your WebLogic Server domain was created by a user different from the user that installed WebLogic Server, the WebLogic Server administrator must change the permissions on the `uddi.properties` file to give access to all users.

3. Restart WebLogic Server.

Never edit the `uddi.properties` file while WebLogic Server is running. Should you modify this file in a way that prevents the successful startup of the UDDI Server, refer to the *`WL_HOME`*`/server/lib/uddi.properties.booted` file for the last known good configuration.

To restore your configuration to its default, remove the `uddi.properties` file from the *`WL_HOME`*`/server/lib` directory. BEA strongly recommends that you move this file to a backup location, because a new `uddi.properties` file will be created and with its successful startup, the `uddi.properties.booted` file will also be overwritten. After removing the properties file, start the server. Minimal default properties will be loaded and written to a newly created `uddi.properties` file.

The following section describes the UDDI Server properties that you can include in the `uddi.properites` file. The list of properties has been divided according to component, usage, and functionality. At any given time, you do not need all these properties to be present.

Configuring an External LDAP Server

The UDDI 2.0 Server is automatically configured with an embedded LDAP server. You can, however, also configure an external LDAP Server by following the procedure in this section.

Note: Currently, WebLogic Server supports only the SunOne Directory Server for use with the UDDI 2.0 Server.

To configure the SunOne Directory Server to be used with UDDI, follow these steps:

1. Create a file called `51acumen.ldif` in the *`LDAP_DIR`*`/Sun/MPS/slapd-`*`LDAP_INSTANCE_NAME`*`/config/schema` directory, where *`LDAP_DIR`* refers to the root installation directory of your SunOne Directory Server and *`LDAP_INSTANCE_NAME`* refers to the instance name.

2. Update the `51acumen.ldif` file with the content described in "51acumen.ldif File Contents" on page 12-6.

3. Restart the SunOne Directory Server.

4. Update the `uddi.properties` file of the WebLogic UDDI 2.0 Server, adding the following properties:

   ```
   datasource.ldap.manager.password
   datasource.ldap.manager.uid
   datasource.ldap.server.root
   datasource.ldap.server.url
   ```

   The value of the properties depends on the configuration of your SunOne Directory Server. The following example shows a possible configuration that uses default values:

   ```
   datasource.ldap.manager.password=password
   datasource.ldap.manager.uid=cn=Directory Manager
   datasource.ldap.server.root=dc=beasys,dc=com
   datasource.ldap.server.url=ldap://host:port
   ```

   See Table 12-11, "LDAP Security Configuration," on page 12-19 for information about these properties.

5. Restart WebLogic Server.

51acumen.ldif File Contents

Use the following content to create the `51acumen.ldif` file:

```
dn: cn=schema
#
# attribute types:
```

```
#
attributeTypes: ( 11827.0001.1.0 NAME 'uddi-Business-Key'               DESC
'Business Key' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.1 NAME 'uddi-Authorized-Name'            DESC
'Authorized Name for publisher of data' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.2 NAME 'uddi-Operator'                   DESC
'Name of UDDI Registry Operator' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255}
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.3 NAME 'uddi-Name'                       DESC
'Business Entity Name' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{258} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.4 NAME 'uddi-Description'                DESC
'Description of Business Entity' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255}
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.7 NAME 'uddi-Use-Type'                   DESC
'Name of convention that the referenced document follows' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.8 NAME 'uddi-URL'                        DESC
'URL' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.9 NAME 'uddi-Person-Name'                DESC
'Name of Contact Person' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.10 NAME 'uddi-Phone'                     DESC
'Telephone Number' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{50} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.11 NAME 'uddi-Email'                     DESC
'Email address' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.12 NAME 'uddi-Sort-Code'                 DESC
'Code to sort addresses' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{10} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.13 NAME 'uddi-tModel-Key'                DESC
'Key to reference a tModel entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255}
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.14 NAME 'uddi-Address-Line'              DESC
'Actual address lines in free form text' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{80} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.15 NAME 'uddi-Service-Key'               DESC
'Service Key' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.16 NAME 'uddi-Service-Name'              DESC
'Service Name' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.17 NAME 'uddi-Binding-Key'               DESC
'Binding Key' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.18 NAME 'uddi-Access-Point'            DESC 'A
```

```
text field to convey the entry point address for calling a web service' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.19 NAME 'uddi-Hosting-Redirector'         DESC
'Provides a Binding Key attribute to redirect reference to a different binding
template' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.20 NAME 'uddi-Instance-Parms'             DESC
'Parameters to use a specific facet of a bindingTemplate description' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.21 NAME 'uddi-Overview-URL'               DESC
'URL reference to a long form of an overview document' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.22 NAME 'uddi-From-Key'                   DESC
'Unique key reference to first businessEntity assertion is made for' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.23 NAME 'uddi-To-Key'                     DESC
'Unique key reference to second businessEntity assertion is made for' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{41} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.24 NAME 'uddi-Key-Name'                   DESC
'An attribute of the KeyedReference structure' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.25 NAME 'uddi-Key-Value'                  DESC
'An attribute of the KeyedReference structure' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.26 NAME 'uddi-Auth-Info'                  DESC
'Authorization information' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{4096} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.27 NAME 'uddi-Key-Type'                   DESC
'The key for all UDDI entries' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{16} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.28 NAME 'uddi-Upload-Register'            DESC
'The upload register' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.29 NAME 'uddi-URL-Type'                   DESC
'The type for the URL' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{16} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.30 NAME 'uddi-Ref-Keyed-Reference'        DESC
'reference to a keyedReference entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.12{255}
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.31 NAME 'uddi-Ref-Category-Bag'           DESC
'reference to a categoryBag entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.12{255}
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.32 NAME 'uddi-Ref-Identifier-Bag'         DESC
'reference to a identifierBag entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.12{255}
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.33 NAME 'uddi-Ref-TModel'                 DESC
'reference to a TModel entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.12{255}
SINGLE-VALUE X-ORIGIN 'acumen defined' )
# id names for each entry
```

```
attributeTypes: ( 11827.0001.1.34 NAME 'uddi-Contact-ID'                DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.35 NAME 'uddi-Discovery-URL-ID'          DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.36 NAME 'uddi-Address-ID'                DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.37 NAME 'uddi-Overview-Doc-ID'           DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.38 NAME 'uddi-Instance-Details-ID'       DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.39 NAME 'uddi-tModel-Instance-Info-ID'   DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.40 NAME 'uddi-Publisher-Assertions-ID'   DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.41 NAME 'uddi-Keyed-Reference-ID'        DESC
'Unique ID which will serve as the Distinguished Name of each entry' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{16} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.42 NAME 'uddi-Ref-Attribute'           DESC 'a
reference to another entry' SYNTAX 1.3.6.1.4.1.1466.115.121.1.12{255} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.43 NAME 'uddi-Entity-Name'               DESC
'Business entity Name' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{258} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.44 NAME 'uddi-tModel-Name'               DESC
'tModel Name' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255} X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.45 NAME 'uddi-tMII-TModel-Key'           DESC
'tModel key referneced in tModelInstanceInfo' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.46 NAME 'uddi-Keyed-Reference-TModel-Key' DESC
'tModel key referneced in KeyedReference' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.47 NAME 'uddi-Address-tModel-Key'        DESC
'tModel key referneced in Address' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255}
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.48 NAME 'uddi-isHidden'                DESC 'a
flag to indicate whether an entry is hidden' SYNTAX
1.3.6.1.4.1.1466.115.121.1.15{255} SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.49 NAME 'uddi-Time-Stamp'                DESC
'modification time satmp' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{255}
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.50 NAME 'uddi-next-id'                   DESC
```

```
'generic counter' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.51 NAME 'uddi-tModel-origin'              DESC
'tModel origin' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.52 NAME 'uddi-tModel-type'                DESC
'tModel type' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE X-ORIGIN 'acumen
defined' )
attributeTypes: ( 11827.0001.1.53 NAME 'uddi-tModel-checked'             DESC
'tModel field to check or not' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.54 NAME 'uddi-user-quota-entity'          DESC
'quota for business entity' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27 SINGLE-VALUE
X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.55 NAME 'uddi-user-quota-service'         DESC
'quota for business services per entity' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.56 NAME 'uddi-user-quota-binding'         DESC
'quota for binding templates per service' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.57 NAME 'uddi-user-quota-tmodel'          DESC
'quota for tmodels' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27 SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.58 NAME 'uddi-user-quota-assertion'       DESC
'quota for publisher assertions' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.59 NAME 'uddi-user-quota-messagesize'     DESC
'quota for maximum message size' SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
SINGLE-VALUE X-ORIGIN 'acumen defined' )
attributeTypes: ( 11827.0001.1.60 NAME 'uddi-user-language'              DESC
'user language' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.61 NAME 'uddi-Name-Soundex'               DESC
'name in soundex format' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{258} X-ORIGIN
'acumen defined' )
attributeTypes: ( 11827.0001.1.62 NAME 'uddi-var'                        DESC
'generic variable' SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 X-ORIGIN 'acumen
defined' )
#
# objectclasses:
#
objectClasses: ( 11827.0001.2.0 NAME 'uddi-Business-Entity'             DESC
'Business Entity object' SUP top STRUCTURAL MUST (uddi-Business-Key $
uddi-Entity-Name $ uddi-isHidden $ uddi-Authorized-Name ) MAY (
uddi-Name-Soundex $ uddi-Operator $ uddi-Description $ uddi-Ref-Identifier-Bag
$ uddi-Ref-Category-Bag ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.1 NAME 'uddi-Business-Service'            DESC
'Business Service object' SUP top STRUCTURAL MUST ( uddi-Service-Key $
uddi-Service-Name $ uddi-isHidden ) MAY ( uddi-Name-Soundex $ uddi-Description
```

```
$ uddi-Ref-Category-Bag ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.2 NAME 'uddi-Binding-Template'           DESC
'Binding Template object' SUP TOP STRUCTURAL   MUST ( uddi-Binding-Key $
uddi-isHidden ) MAY ( uddi-Description $ uddi-Access-Point $
uddi-Hosting-Redirector ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.3 NAME 'uddi-tModel'                     DESC
'tModel object' SUP top STRUCTURAL   MUST (uddi-tModel-Key $ uddi-tModel-Name $
uddi-isHidden $ uddi-Authorized-Name ) MAY ( uddi-Name-Soundex $ uddi-Operator
$ uddi-Description $ uddi-Ref-Identifier-Bag $ uddi-Ref-Category-Bag $
uddi-tModel-origin $ uddi-tModel-checked $ uddi-tModel-type ) X-ORIGIN 'acumen
defined' )
objectClasses: ( 11827.0001.2.4 NAME 'uddi-Publisher-Assertion'        DESC
'Publisher Assertion object' SUP TOP STRUCTURAL   MUST (
uddi-Publisher-Assertions-ID $ uddi-From-Key $ uddi-To-Key $
uddi-Ref-Keyed-Reference ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.5 NAME 'uddi-Discovery-URL'              DESC
'Discovery URL' SUP TOP STRUCTURAL  MUST ( uddi-Discovery-URL-ID $ uddi-Use-Type
$ uddi-URL ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.6 NAME 'uddi-Contact'                    DESC
'Contact Information' SUP TOP STRUCTURAL   MUST ( uddi-Contact-ID $
uddi-Person-Name ) MAY ( uddi-Use-Type $ uddi-Description $ uddi-Phone $
uddi-Email $ uddi-tModel-Key ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.7 NAME 'uddi-Address'                    DESC
'Address information for a contact entry' SUP TOP STRUCTURAL   MUST (
uddi-Address-ID ) MAY ( uddi-Use-Type $ uddi-Sort-Code $ uddi-Address-tModel-Key
$ uddi-Address-Line ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.8 NAME 'uddi-Keyed-Reference'            DESC
'KeyedReference' SUP TOP STRUCTURAL   MUST ( uddi-Keyed-Reference-ID $
uddi-Key-Value ) MAY ( uddi-Key-Name $ uddi-Keyed-Reference-TModel-Key )
X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.9 NAME 'uddi-tModel-Instance-Info'       DESC
'tModelInstanceInfo' SUP TOP STRUCTURAL   MUST ( uddi-tModel-Instance-Info-ID $
uddi-tMII-TModel-Key ) MAY ( uddi-Description ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.10 NAME 'uddi-Instance-Details'          DESC
'instanceDetails' SUP TOP STRUCTURAL   MUST ( uddi-Instance-Details-ID ) MAY (
uddi-Description $ uddi-Instance-Parms ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.11 NAME 'uddi-Overview-Doc'              DESC
'overviewDoc' SUP TOP STRUCTURAL   MUST ( uddi-Overview-Doc-ID ) MAY (
uddi-Description $ uddi-Overview-URL ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.12 NAME 'uddi-Ref-Object'                DESC
'an object class conatins a reference to another entry' SUP TOP STRUCTURAL MUST
( uddi-Ref-Attribute ) X-ORIGIN 'acumen defined' )
objectClasses: ( 11827.0001.2.13 NAME 'uddi-Ref-Auxiliary-Object'      DESC
'an auxiliary type object used in another structural class to hold a reference
to a third entry' SUP TOP AUXILIARY MUST ( uddi-Ref-Attribute ) X-ORIGIN 'acumen
defined' )
objectClasses: ( 11827.0001.2.14 NAME 'uddi-ou-container'              DESC
'an organizational unit with uddi attributes' SUP organizationalunit STRUCTURAL
MAY ( uddi-next-id $ uddi-var ) X-ORIGIN 'acumen defined' )
```

```
objectClasses: ( 11827.0001.2.15 NAME 'uddi-User'                    DESC 'a
User with uddi attributes' SUP inetOrgPerson STRUCTURAL MUST ( uid $
uddi-user-language $ uddi-user-quota-entity $ uddi-user-quota-service $
uddi-user-quota-tmodel $ uddi-user-quota-binding $ uddi-user-quota-assertion $
uddi-user-quota-messagesize ) X-ORIGIN 'acumen defined' )
```

Description of Properties in the uddi.properties File

The following tables describe properties of the `uddi.properties` file, categorized by the type of UDDI feature they describe:

- Basic UDDI Configuration
- UDDI User Defaults
- General Server Configuration
- Logger Configuration
- Connection Pools
- LDAP Datastore Configuration
- Replicated LDAP Datastore Configuration
- File Datastore Configuration
- General Security Configuration
- LDAP Security Configuration
- File Security Configuration

Table 12-2 Basic UDDI Configuration

UDDI Property Key	Description
auddi.discoveryurl	DiscoveryURL prefix that is set for each saved business entity. Typically this is the full URL to the uddilistener servlet, so that the full DiscoveryURL results in the display of the stored BusinessEntity data.
auddi.inquiry.secure	Permissible values are `true` and `false`. When set to `true`, inquiry calls to UDDI Server are limited to secure https connections only. Any UDDI inquiry calls through a regular http URL are rejected.
auddi.publish.secure	Permissible values are `true` and `false`. When set to `true`, publish calls to UDDI Server are limited to secure https connections only. Any UDDI publish calls through a regular http URL are rejected.
auddi.search.maxrows	Maximum number of returned rows for search operations. When the search results in a higher number of rows then the limit set by this property, the result is truncated.
auddi.search.timeout	Timeout value for search operations. The value is indicated in milliseconds.
auddi.siteoperator	Name of the UDDI registry site operator. The specified value will be used as the operator attribute, saved in all future BusinessEntity registrations. This attribute will later be returned in responses, and indicates which UDDI registry has generated the response.
security.cred.life	Credential life, specified in seconds, for authentication. Upon authentication of a user, an AuthToken is assigned which will be valid for the duration specified by this property.
pluggableTModel.file.list	UDDI Server is pre-populated with a set of Standard TModels. You can further customize the UDDI server by providing your own taxonomies, in the form of TModels. Taxonomies must be defined in XML files, following the provided XML schema. The value of this property a comma-separated list of URIs to such XML files. Values that refer to these TModels are checked and validated against the specified taxonomy.

Table 12-3 UDDI User Defaults

UDDI Property Key	Description
auddi.default.lang	User's initial language, assigned to user profile by default at the time of creation. User profile settings can be changed at sign-up or later.
auddi.default.quota.assertion	User's initial assertion quota, assigned to user profile by default at the time of creation. The assertion quota is the maximum number of publisher assertions that the user is allowed to publish. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.
auddi.default.quota.binding	User's initial binding quota, assigned to user profile by default at the time of creation. The binding quota is the maximum number of binding templates that the user is allowed to publish, per each business service. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.
auddi.default.quota.entity	User's initial business entity quota, assigned to user profile by default at the time of creation. The entity quota is the maximum number of business entities that the user is allowed to publish. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.
auddi.default.quota.messageSize	User's initial message size limit, assigned to his user profile by default at the time of creation. The message size limit is the maximum size of a SOAP call that the user may send to UDDI Server. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.
auddi.default.quota.service	User's initial service quota, assigned to user profile by default at the time of creation. The service quota is the maximum number of business services that the user is allowed to publish, per each business entity. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.
auddi.default.quota.tmodel	User's initial TModel quota, assigned to user profile by default at the time of creation. The TModel quota is the maximum number of TModels that the user is allowed to publish. To impose no limits, set a value of -1. A user's profile settings can be changed at sign-up or later.

Table 12-4 General Server Configuration

UDDI Property Keys	Description
auddi.datasource.type	Location of physical storage of UDDI data. This value defaults to `WLS`, which indicates that the internal LDAP directory of WebLogic Server is to be used for data storage. Other permissible values include `LDAP`, `ReplicaLDAP`, and `File`.
auddi.security.type	UDDI Server's security module (authentication). This value defaults to `WLS`, which indicates that the default security realm of WebLogic Server is to be used for UDDI authentication. As such, a WebLogic Server user would be an UDDI Server user and any WebLogic Server administrator would also be an UDDI Server administrator, in addition to members of the UDDI Server administrator group, as defined in UDDI Server settings. Other permissible values include `LDAP` and `File`.
auddi.license.dir	Location of the UDDI Server license file. In the absence of this property, the *`WL_HOME`*`/server/lib` directory is assumed to be the default license directory, where *`WL_HOME`* is the main WebLogic Server installation directory. Some WebLogic users are exempt from requiring a UDDI Server license for the basic UDDI Server components, while they may need a license for additional components (for example., UDDI Server Browser).
auddi.license.file	Name of the license file. In the absence of this property, `uddilicense.xml` is presumed to be the default license filename. Some WebLogic users are exempt from requiring an UDDI Server license for the basic UDDI Server components, while they may need a license for additional components (e.g., UDDI Server Browser).

Table 12-5 Logger Configuration

UDDI Property Key	Description
logger.file.maxsize	Maximum size of logger output files (if output is sent to file), in Kilobytes. Once an output file reaches maximum size, it is closed and a new log file is created.
logger.indent.enabled	Permissible values are `true` and `false`. When set to `true`, log messages beginning with "+" and "-", typically TRACE level logs, cause an increase or decrease of indentation in the output.
logger.indent.size	Size of each indentation (how many spaces for each indent), specified as an integer.
logger.log.dir	Absolute or relative path to a directory where log files are stored.
logger.log.file.stem	String that is prefixed to all log file names.
logger.log.type	Determines whether log messages are sent to the screen, to a file or to both destinations. Permissible values, respectively, are: `LOG_TYPE_SCREEN`, `LOG_TYPE_FILE`, and `LOG_TYPE_SCREEN_FILE`.
logger.output.style	Determines whether logged output will simply contain the message, or thread and timestamp information will be included. Permissible values are `OUTPUT_LONG` and `OUTPUT_SHORT`.
logger.quiet	Determines whether the logger itself displays information messages. Permissible values are `true` and `false`.
logger.verbosity	Logger's verbosity level. Permissible values (case sensitive) are `TRACE`, `DEBUG`, `INFO`, `WARNING` and `ERROR`, where each severity level includes the following ones accumulatively.

Table 12-6 Connection Pools

UDDI Property Key	Description
datasource.ldap.pool.increment	Number of new connections to create and add to the pool when all connections in the pool are busy
datasource.ldap.pool.initialsize	Number of connections to be stored at the time of creation and initialization of the pool.
datasource.ldap.pool.maxsize	Maximum number of connections that the pool may hold.
datasource.ldap.pool.systemmaxsize	Maximum number of connections created, even after the pool has reached its capacity. Once the pool reaches its maximum size, and all connections are busy, connections are temporarily created and returned to the client, but not stored in the pool. However, once the system max size is reached, all requests for new connections are blocked until a previously busy connection becomes available.

Table 12-7 LDAP Datastore Configuration

UDDI Property Key	Description
datasource.ldap.manager.uid	Back-end LDAP server administrator or privileged user ID, (for example, cn=Directory Manager) who can save data in LDAP.
datasource.ldap.manager.password	Password for the datasource.ldap.manager.uid, establishes connections with the LDAP directory used for data storage.
datasource.ldap.server.url	"ldap://" URL to the LDAP directory used for data storage.
datasource.ldap.server.root	Root entry of the LDAP directory used for data storage (e.g., dc=acumenat, dc=com).

Note: In a replicated LDAP environment, there are "m" LDAP masters and "n" LDAP replicas, respectively numbered from 0 to (m-1) and from 0 to (n-1). The fifth part of the property keys below, quoted as "i", refers to this number and differs for each LDAP server instance defined.

Table 12-8 Replicated LDAP Datastore Configuration

UDDI Property Key	Description
datasource.ldap.server.master.i.manager.uid	Administrator or privileged user ID for this "master" LDAP server node, (for example, cn=Directory Manager) who can save data in LDAP.
datasource.ldap.server.master.i.manager.password	Password for the datasource.ldap.server.master.i.manager.uid, establishes connections with the relevant "master" LDAP directory to write data.
datasource.ldap.server.master.i.url	"ldap://" URL to the corresponding LDAP directory node.
datasource.ldap.server.master.i.root	Root entry of the corresponding LDAP directory node (for example, dc=acumenat, dc=com).
datasource.ldap.server.replica.i.manager.uid	User ID for this "replica" LDAP server node (for example, cn=Directory Manager); this person can read the UDDI data from LDAP.
datasource.ldap.server.replica.i.manager.password	Password for datasource.ldap.server.replica.i.manager.uid, establishes connections with the relevant "replica" LDAP directory to read data.
datasource.ldap.server.replica.i.url	"ldap://" URL to the corresponding LDAP directory node.
datasource.ldap.server.replica.i.root	Root entry of the corresponding LDAP directory node (for example, dc=acumenat, dc=com).

Table 12-9 File Datastore Configuration

UDDI Property Key	Description
datasource.file.directory	Directory where UDDI data is stored in the file system.

Table 12-10 General Security Configuration

UDDI Property Key	Description
security.custom.group.operators	Security group name, where the members of this group are treated as UDDI administrators.

Table 12-11 LDAP Security Configuration

UDDI Property Key	Description
security.custom.ldap.manager.uid	Security LDAP server administrator or privileged user ID (for example, cn=Directory Manager); this person can save data in LDAP.
security.custom.ldap.manager.password	The value of this property is the password for the above user ID, and is used to establish connections with the LDAP directory used for security.
security.custom.ldap.url	The value of this property is an "ldap://" URL to the LDAP directory used for security.
security.custom.ldap.root	Root entry of the LDAP directory used for security (for example, dc=acumenat, dc=com).
security.custom.ldap.userroot	User's root entry on the security LDAP server. For example, ou=People.
security.custom.ldap.group.root	Operator entry on the security LDAP server. For example, "cn=UDDI Administrators, ou=Groups". This entry contains IDs of all UDDI administrators.

Table 12-12 File Security Configuration

UDDI Property Key	Description
security.custom.file.userdir	Directory where UDDI security information (users and groups) is stored in the file system.

UDDI Directory Explorer

The UDDI Directory Explorer allows authorized users to publish Web Services in private WebLogic Server UDDI registries and to modify information for previously published Web Services. The Directory Explorer provides access to details about the Web Services and associated WSDL files (if available.)

The UDDI Directory Explorer also enables you to search both public and private UDDI registries for Web Services and information about the companies and departments that provide these Web Services.

To invoke the UDDI Directory Explorer in your browser, enter:

```
http://host:port/uddiexplorer
```

where

- *`host`* is the computer on which WebLogic Server is running.
- *`port`* is the port number where WebLogic Server listens for connection requests. The default port number is 7001.

You can perform the following tasks with the UDDI Directory Explorer:

- Search public registries
- Search private registries
- Publish to a private registry
- Modify private registry details
- Setup UDDI directory explorer

For more information about using the UDDI Directory Explorer, click the **Explorer Help** link on the main page.

UDDI Client API

WebLogic Server includes an implementation of the client-side UDDI API that you can use in your Java client applications to programmatically search for and publish Web Services.

The two main classes of the UDDI client API are `Inquiry` and `Publish`. Use the `Inquiry` class to search for Web Services in a known UDDI registry and the `Publish` class to add your Web Service to a known registry.

WebLogic Server provides an implementation of the following client UDDI API packages:

- weblogic.uddi.client.service
- weblogic.uddi.client.structures.datatypes
- weblogic.uddi.client.structures.exception
- weblogic.uddi.client.structures.request
- weblogic.uddi.client.structures.response

For detailed information on using these packages, see the UDDI API Javadocs at http://e-docs.bea.com/wls/docs90/javadocs/index.html.

Pluggable tModel

A taxonomy is basically a tModel used as reference by a categoryBag or identifierBag. A major distinction is that in contrast to a simple tModel, references to a taxonomy are typically checked and validated. WebLogic Server's UDDI Server takes advantage of this concept and extends this capability by introducing custom taxonomies, called "pluggable tModels". Pluggable tModels allow users (UDDI administrators) to add their own checked taxonomies to the UDDI registry, or overwrite standard taxonomies.

To add a pluggable tModel:

1. Create an XML file conforming to the specified format described in "XML Schema for Pluggable tModels" on page 12-23, for each tModelKey/categorization.
2. Add the comma-delimited, fully qualified file names to the `pluggableTModel.file.list` property in the `uddi.properties` file used to configure UDDI Server. For example:

   ```
   pluggableTModel.file.list=c:/temp/cat1.xml,c:/temp/cat2.xml
   ```

   See "Configuring the UDDI 2.0 Server" on page 12-5 for details about the uddi.properties file.
3. Restart WebLogic Server.

The following sections include a table detailing the XML elements and their permissible values, the XML schema against which pluggable tModels are validated, and a sample XML.

XML Elements and Permissible Values

The following table describes the elements of the XML file that describes your pluggable tModels.

Table 12-13 Description of the XML Elements to Configure Pluggable tModels

Element/Attribute	Required	Role	Values	Comments
Taxonomy	Required	Root Element		
checked	Required	Whether this categorization is checked or not.	true / false	If false, keyValue will not be validated.
type	Required	The type of the tModel.	categorization / identifier / valid values as defined in uddi-org-types	See uddi-org-types tModel for valid values.
applicability	Optional	Constraints on where the tModel may be used.		No constraint is assumed if this element is not provided
scope	Required if the applicability element is included.		businessEntity / businessService / bindingTemplate / tModel	tModel may be used in tModelInstanceInfo if scope "bindingTemplate" is specified.
tModel	Required	The actual tModel, according to the UDDI data structure.	Valid tModelKey must be provided.	
categories	Required if checked is set to true.			
category	Required if element categories is included	Holds actual keyName and keyValue pairs.	keyName / keyValue pairs	category may be nested for grouping or tree structure.

Table 12-13 Description of the XML Elements to Configure Pluggable tModels

Element/Attribute	Required	Role	Values	Comments
keyName	Required			
keyValue	Required			

XML Schema for Pluggable tModels

The XML Schema against which pluggable tModels are validated is as follows:

```
<simpleType name="type">
  <restriction base="string"/>
</simpleType>

<simpleType name="checked">
  <restriction base="NMTOKEN">
    <enumeration value="true"/>
    <enumeration value="false"/>
  </restriction>
</simpleType>

<element name="scope" type="string"/>

<element name = "applicability" type = "uddi:applicability"/>

<complexType name = "applicability">
  <sequence>
    <element ref = "uddi:scope" minOccurs = "1" maxOccurs = "4"/>
  </sequence>
</complexType>

<element name="category" type="uddi:category"/>

<complexType name = "category">
  <sequence>
   <element ref = "uddi:category" minOccurs = "0" maxOccurs = "unbounded"/>

  </sequence>
  <attribute name = "keyName" use = "required" type="string"/>
  <attribute name = "keyValue" use = "required" type="string"/>
</complexType>
```

```
<element name="categories" type="uddi:categories"/>

<complexType name = "categories">
  <sequence>
   <element ref = "uddi:category" minOccurs = "1" maxOccurs = "unbounded"/>
  </sequence>
</complexType>

<element name="Taxonomy" type="uddi:Taxonomy"/>

<complexType name="Taxonomy">
  <sequence>
    <element ref = "uddi:applicability" minOccurs = "0" maxOccurs = "1"/>
    <element ref = "uddi:tModel" minOccurs = "1" maxOccurs = "1"/>
    <element ref = "uddi:categories" minOccurs = "0" maxOccurs = "1"/>
  </sequence>
  <attribute name = "type" use = "required" type="uddi:type"/>
  <attribute name = "checked" use = "required" type="uddi:checked"/>
</complexType>
```

Sample XML for a Pluggable tModel

The following shows a sample XML for a pluggable tModel:

```
<?xml version="1.0" encoding="UTF-8" ?>

  <SOAP-ENV:Envelope
      xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">

  <SOAP-ENV:Body>

   <Taxonomy checked="true" type="categorization" xmlns="urn:uddi-org:api_v2" >
    <applicability>
        <scope>businessEntity</scope>
        <scope>businessService</scope>
        <scope>bindingTemplate</scope>
    </applicability>
    <tModel  tModelKey="uuid:C0B9FE13-179F-41DF-8A5B-5004DB444tt2" >
        <name> sample pluggable tModel </name>
        <description>used for test purpose only </description>
            <overviewDoc>
                <overviewURL>http://www.abc.com </overviewURL>
            </overviewDoc>
    </tModel>
    <categories>
        <category keyName="name1 " keyValue="1">
```

```
            <category keyName="name11" keyValue="12">
                <category keyName="name111" keyValue="111">
                    <category keyName="name1111" keyValue="1111"/>
                    <category keyName="name1112" keyValue="1112"/>
                </category>
                <category keyName="name112" keyValue="112">
                    <category keyName="name1121" keyValue="1121"/>
                    <category keyName="name1122" keyValue="1122"/>
                </category>
            </category>
        </category>
        <category keyName="name2 " keyValue="2">
            <category keyName="name21" keyValue="22">
                <category keyName="name211" keyValue="211">
                    <category keyName="name2111" keyValue="2111"/>
                    <category keyName="name2112" keyValue="2112"/>
                </category>
                <category keyName="name212" keyValue="212">
                    <category keyName="name2121" keyValue="2121"/>
                    <category keyName="name2122" keyValue="2122"/>
                </category>
            </category>
        </category>
    </categories>
   </Taxonomy>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Upgrading an 8.1 Web Service to 9.0

The following sections describe how to upgrade a WebLogic Server 8.1 Web Service to run in the 9.0 Web Service runtime environment:

- "Overview of Upgrading an 8.1 WebLogic Web Service" on page 13-1
- "Upgrading an 8.1 Java Class-Implemented WebLogic Web Service to 9.0: Main Steps" on page 13-2
- "Upgrading an 8.1 EJB-Implemented WebLogic Web Service to 9.0: Main Steps" on page 13-9
- "Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes" on page 13-19

Overview of Upgrading an 8.1 WebLogic Web Service

This section describes how to upgrade an 8.1 WebLogic Web Service to use the new Version 9.0 Web Services runtime environment. This runtime is based on the *Implementing Enterprise Web Services* 1.1 specification (JSR-921, which is the 1.1 maintenance release of JSR-109). The 9.0 programming model uses standard JDK 1.5 metadata annotations, as specified by the *Web Services Metadata for the Java Platform* specification (JSR-181).

Note: 8.1 WebLogic Web Services will continue to run, without any changes, on Version 9.0 of WebLogic Server because the 8.1 Web Services runtime is still supported in 9.0, although it is deprecated and will be removed from the product in future releases. For this reason, BEA highly recommends that you follow the instructions in this chapter to upgrade your 8.1 Web Service to 9.0.

Upgrading your 8.1 Web Service includes the following high-level tasks; the procedures in later sections go into more detail:

- Update the 8.1 Java source code of the Java class or stateless session EJB that implements the Web Service so that the source code uses JWS annotations.

  Version 9.0 WebLogic Web Services are implemented using JWS files, which are Java files that contains JWS annotations. You do *not* specify whether the underlying implementation of the Web Service is a Java class or a stateless EJB; this decision is left up to the `jwsc` Ant task. This programming model differs from that of 8.1, where you did specify the type of backend component (Java class or EJB).

- Update the Ant build script that builds the Web Service to call the 9.0 WebLogic Web Service Ant task `jwsc` instead of the 8.1 `servicegen` task.

In the sections that follow it is assumed that:

- You previously used `servicegen` to generate your 8.1 Web Service and that, more generally, you use Ant scripts in your development environment to iteratively develop Web Services and other J2EE artifacts that run on WebLogic Server. The procedures in this section direct you to update existing Ant `build.xml` files.
- You have access to the Java class or EJB source code for your 8.1 Web Service.

This section does *not* discuss the following topics:

- Upgrading a JMS-implemented 8.1 Web Service.
- Upgrading Web Services from versions previous to 8.1.
- Upgrading a client application that invokes an 8.1 Web Service to one that invokes a 9.0 Web Service. For details on how to write a client application that invokes a 9.0 Web Service, see Chapter 9, "Invoking Web Services."

Upgrading an 8.1 Java Class-Implemented WebLogic Web Service to 9.0: Main Steps

To upgrade an 8.1 Java class-implemented Web Service to use the 9.0 WebLogic Web Services runtime:

1. Open a command window and set your WebLogic Server 9.0 environment by executing the `setDomainEnv.cmd` (Windows) or `setDomainEnv.sh` (UNIX) script, located in the `bin` subdirectory of your 9.0 domain directory.

The default location of WebLogic Server domains is *BEA_HOME*/user_projects/domains/*domainName*, where *BEA_HOME* is the top-level installation directory of the BEA products and *domainName* is the name of your domain.

2. Create a project directory:

```
prompt> mkdir /myExamples/upgrade_pojo
```

3. Create an `src` directory under the project directory, as well as sub-directories that correspond to the package name of the new 9.0 JWS file (shown later in this procedure) that corresponds to the old 8.1 Java class:

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

4. Copy the old Java class that implements the 8.1 Web Service to the `src/examples/webservices/upgrade_pojo` directory of the working directory. Rename the file, if desired.

5. Edit the Java file, as described in the following steps. See the old and new sample Java files in "Example of an 8.1 Java File and the Corresponding 9.0 JWS File" on page 13-5 for specific examples.

   a. If needed, change the package name and class name of the Java file to reflect the new 9.0 source environment.

   b. Add `import` statements to import both the standard and WebLogic-specific JWS annotations.

   c. Add, at a minimum, the following JWS annotation:

   – The standard `@WebService` annotation at the Java class level to specify that the JWS file implements a Web Service.

   BEA recommends you also add the following annotations:

   – The standard `@SOAPBinding` annotation at the class-level to specify the type of Web Service, such as document-literal-wrapped or RPC-encoded.

   – The WebLogic-specific `@WLHttpTransport` annotation at the class-level to specify the context and service URIs that are used in the URL that invokes the deployed Web Service.

   – The standard `@WebMethod` annotation at the method-level for each method that is exposed as a Web Service operation.

   See Chapter 5, "Programming the JWS File," for general information about using JWS annotations in a Java file.

   d. You might need to add additional annotations to your JWS file, depending on the 8.1 Web Service features you want to carry forward to 9.0. In 8.1, many of these features were configured with attributes of `servicegen`. See "Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes" on page 13-19 for a table that lists equivalent JWS annotation, if available, for features you enabled in 8.1 using `servicegen` attributes.

6. Copy the old `build.xml` file that built the 8.1 Web Service to the 9.0 working directory.

7. Update your Ant `build.xml` file to execute the `jwsc` Ant task, along with other supporting tasks, instead of `servicegen`.

   BEA recommends that you create a new target, such as `build-service`, in your Ant build file and add the `jwsc` Ant task call to compile the new JWS file you created in the preceding steps. Once this target is working correctly, you can remove the old `servicegen` Ant task.

   The following procedure lists the main steps to update your `build.xml` file; for details on the steps, see the standard iterative development process outlined in Chapter 4, "Iterative Development of WebLogic Web Services."

   See "Example of an 8.1 and Updated 9.0 Ant Build File for Java Class-Implemented Web Services" on page 13-7 for specific examples of the steps in the following procedure.

   a. Add the `jwsc` taskdef to the `build.xml` file.

   b. Create a `build-service` target and add the tasks needed to build the 9.0 Web Service, as described in the following steps.

   c. Add the `jwsc` task to the build file. Set the `srdir` attribute to the src directory (`/myExamples/upgrade_pojo/src`, in this example) and the `destdir` attribute to the root Enterprise application directory you created in the preceding step.

      Set the `file` attribute of the `<jws>` child element to the name of the new JWS file, created earlier in this procedure.

      You may need to specify additional attributes to the `jwsc` task, depending on the 8.1 Web Service features you want to carry forward to 9.0. In 8.1, many of these features were configured using attributes of `servicegen`. See "Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes" on page 13-19 for a table that describes if there is an equivalent `jwsc` attribute for features you enabled using `servicegen` attributes.

8. Execute the `build-service` Ant target. Assuming all the tasks complete successfully, the resulting Enterprise application contains your upgraded 9.0 Web Service.

See “Deploying and Undeploying WebLogic Web Services” on page 4-13 and “Browsing to the WSDL of the Web Service” on page 4-15 for additional information about deploying and testing your Web Service.

Based on the sample Java code shown in the following sections, the URL to invoke the WSDL of the upgraded 9.0 Web Service is:

`http://`*`host`*`:`*`port`*`/upgradePOJO/HelloWorld?WSDL`

Example of an 8.1 Java File and the Corresponding 9.0 JWS File

Assume that the following sample Java class implemented a 8.1 Web Service:

```
package examples.javaclass;

/**
 * Simple Java class that implements the HelloWorld Web service.  It takes
 * as input an integer and a String, and returns a message that includes these
 * two parameters.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public final class HelloWorld81 {

  /**
   * Returns a text message that includes the integer and String input
   * parameters.
   *
   */
  public String sayHello(int num, String s) {

    System.out.println("sayHello operation has been invoked with arguments " +
s + " and " + num);

    String returnValue = "This message brought to you by the letter "+s+" and
the number "+num;

    return returnValue;
  }

}
```

An equivalent JWS file for a 9.0 Java class-implemented Web Service is shown below, with the differences shown in bold. Note that some of the JWS annotation values are taken from attributes of the 8.1 `servicegen` Ant task shown in "Example of an 8.1 and Updated 9.0 Ant Build File for Java Class-Implemented Web Services" on page 13-7:

```
package examples.webservices.upgrade_pojo;

// Import standard JWS annotations

import javax.jws.WebService;
import javax.jws.WebMethod;
import javax.jws.soap.SOAPBinding;

// Import WebLogic JWS anntoation

import weblogic.jws.WLHttpTransport;

/**
 * Simple Java class that implements the HelloWorld90 Web service.  It takes
 * as input an integer and a String, and returns a message that includes these
 * two parameters.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

@WebService(name="HelloWorld90PortType", serviceName="HelloWorld",
            targetNamespace="http://example.org")

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

@WLHttpTransport(contextPath="upgradePOJO", serviceUri="HelloWorld",
                 portName="HelloWorld90Port")

public class HelloWorld90Impl {

  /**
   * Returns a text message that includes the integer and String input
   * parameters.
   *
   */

  @WebMethod()
  public String sayHello(int num, String s) {

    System.out.println("sayHello operation has been invoked with arguments " +
s + " and " + num);

    String returnValue = "This message brought to you by the letter "+s+" and
the number "+num;
```

```
    return returnValue;
  }
}
```

Example of an 8.1 and Updated 9.0 Ant Build File for Java Class-Implemented Web Services

The following simple `build.xml` file shows the 8.1 way to build a WebLogic Web Service using the `servicegen` Ant task; in the example, the Java file that implements the 8.1 Web Service has already been compiled into the `examples.javaclass.HelloWorld81` class:

```
<project name="javaclass-webservice" default="all" basedir=".">

  <!-- set global properties for this build -->
  <property name="source" value="."/>
  <property name="build" value="${source}/build"/>
  <property name="war_file" value="HelloWorldWS.war" />
  <property name="ear_file" value="HelloWorldApp.ear" />
  <property name="namespace" value="http://examples.org" />

  <target name="all" depends="clean, ear"/>

  <target name="clean">
    <delete dir="${build}"/>
  </target>

  <!-- example of old 8.1 servicegen call to build Web Service -->

  <target name="ear">
    <servicegen
       destEar="${build}/${ear_file}"
       warName="${war_file}">
       <service
         javaClassComponents="examples.javaclass.HelloWorld81"
         targetNamespace="${namespace}"
         serviceName="HelloWorld"
         serviceURI="/HelloWorld"
         generateTypes="True"
         expandMethods="True">
       </service>
     </servicegen>
  </target>
```

```
</project>
```

An equivalent `build.xml` file that calls the `jwsc` Ant task to build a 9.0 Web Service is shown below, with the relevant tasks discussed in this section in bold. In the example, the new JWS file that implements the 9.0 Web Service is called `HelloWorld90Impl.java`:

```
<project name="webservices-upgrade_pojo" 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="upgradePOJOEar" />
  <property name="example-output" value="output" />
  <property name="ear-dir" value="${example-output}/upgradePOJOEar" />

  <taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

  <taskdef name="wldeploy"
    classname="weblogic.ant.taskdefs.management.WLDeploy"/>

  <target name="all" depends="clean,build-service,deploy" />

  <target name="clean" depends="undeploy">
    <delete dir="${example-output}"/>
  </target>

  <target name="build-service">

    <jwsc
      srcdir="src"
      destdir="${ear-dir}">

     <jws file="examples/webservices/upgrade_pojo/HelloWorld90Impl.java" />

    </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>

</project>
```

Upgrading an 8.1 EJB-Implemented WebLogic Web Service to 9.0: Main Steps

The following procedure describes how to upgrade an 8.1 EJB-implemented Web Service to use the 9.0 WebLogic Web Services runtime.

The 9.0 Web Services programming model is quite different from the 8.1 model in that it hides the underlying implementation of the Web Service. Rather than specifying up front that you want the Web Service to be implemented by a Java class or an EJB, you let the jwsc Ant task decide which is the best implementation. For this reason, the following procedure does not show how to import EJB classes or use EJBGen, even though the 8.1 Web Service was explicitly implemented with an EJB. Instead, the procedure shows how to create a standard JWS file that is the 9.0 equivalent to the 8.1 EJB-implemented Web Service.

1. Open a command window and set your 9.0 WebLogic Server environment by executing the `setDomainEnv.cmd` (Windows) or `setDomainEnv.sh` (UNIX) script, located in the `bin` subdirectory of your 9.0 domain directory.

   The default location of WebLogic Server domains is `BEA_HOME/user_projects/domains/domainName`, where *`BEA_HOME`* is the top-level installation directory of the BEA products and *`domainName`* is the name of your domain.

2. Create a project directory:

   ```
   prompt> mkdir /myExamples/upgrade_ejb
   ```

3. Create a `src` directory under the project directory, as well as sub-directories that correspond to the package name of the new 9.0 JWS file (shown later on in this procedure) that corresponds to your 8.1 EJB implementation:

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

4. Copy the 8.1 EJB Bean file that implemented `javax.ejb.SessionBean` to the `src/examples/webservices/upgrade_ejb` directory of the working directory. Rename the file, if desired.

   Note: You do not need to copy over the 8.1 Home and Remote EJB files.

5. Edit the EJB Bean file, as described in the following steps. See the old and new sample Java files in "Example of 8.1 EJB Files and the Corresponding 9.0 JWS File" on page 13-12 for specific examples.

   a. If needed, change the package name and class name of the Java file to reflect the new 9.0 source environment.

   b. Optionally remove the `import` statements that import the EJB classes (`javax.ejb.*`). These classes are no longer needed in the upgraded JWS file.

   c. Add `import` statements to import both the standard and WebLogic-specific JWS annotations.

   d. Ensure that the JWS file does *not* implement `javax.ejb.SessionBean` anymore by removing the `implements SessionBean` code from the class declaration.

   e. Remove all the EJB-specific methods:

   – `ejbActivate()`

   – `ejbRemove()`

   – `ejbPassivate()`

   – `ejbCreate()`

   f. Add, at a minimum, the following JWS annotation:

   – The standard `@WebService` annotation at the Java class level to specify that the JWS file implements a Web Service.

   BEA recommends you also add the following annotations:

   – The standard `@SOAPBinding` annotation at the class-level to specify the type of Web Service, such as document-literal-wrapped or RPC-encoded.

– The WebLogic-specific `@WLHttpTransport` annotation at the class-level to specify the context and service URIs that are used in the URL that invokes the deployed Web Service.

– The standard `@WebMethod` annotation at the method-level for each method that is exposed as a Web Service operation.

See Chapter 5, "Programming the JWS File," for general information about using JWS annotations in a Java file.

g. You might need to add additional annotations to your JWS file, depending on the 8.1 Web Service features you want to carry forward to 9.0. In 8.1, many of these features were configured using attributes of `servicegen`. See "Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes" on page 13-19 for a table that lists equivalent JWS annotation, if available, for features you enabled in 8.1 using `servicegen` attributes.

6. Copy the old `build.xml` file that built the 8.1 Web Service to the 9.0 working directory.

7. Update your Ant `build.xml` file to execute the `jwsc` Ant task, along with other supporting tasks, instead of `servicegen`.

   BEA recommends that you create a new target, such as `build-service`, in your Ant build file and add the `jwsc` Ant task call to compile the new JWS file you created in the preceding steps. Once this target is working correctly, you can remove the old `servicegen` Ant task.

   The following procedure lists the main steps to update your `build.xml` file; for details on the steps, see the standard iterative development process outlined in Chapter 4, "Iterative Development of WebLogic Web Services."

   See "Example of an 8.1 and Updated 9.0 Ant Build File for an 8.1 EJB-Implemented Web Service" on page 13-16 for specific examples of the steps in the following procedure.

   a. Add the `jwsc` taskdef to the `build.xml` file.

   b. Create a `build-service` target and add the tasks needed to build the 9.0 Web Service, as described in the following steps.

   c. Add the `jwsc` task to the build file. Set the `srdir` attribute to the src directory (`/myExamples/upgrade_ejb/src`, in this example) and the `destdir` attribute to the root Enterprise application directory you created in the preceding step.

      Set the `file` attribute of the `<jws>` child element to the name of the new JWS file, created earlier in this procedure.

You may need to specify additional attributes to the `jwsc` task, depending on the 8.1 Web Service features you want to carry forward to 9.0. In 8.1, many of these features were configured using attributes of `servicegen`. See "Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes" on page 13-19 for a table that indicates whether there is an equivalent `jwsc` attribute for features you enabled using `servicegen` attributes.

8. Execute the `build-service` Ant target. Assuming all tasks complete successfully, the resulting Enterprise application contains your upgraded 9.0 Web Service.

See "Deploying and Undeploying WebLogic Web Services" on page 4-13 and "Browsing to the WSDL of the Web Service" on page 4-15 for additional information about deploying and testing your Web Service.

Based on the sample Java code shown in the following sections, the URL to invoke the WSDL of the upgraded 9.0 Web Service is:

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

Example of 8.1 EJB Files and the Corresponding 9.0 JWS File

Assume that the Bean, Home, and Remote classes and interfaces, shown in the next three sections, implemented the 8.1 stateless session EJB which in turn implemented an 8.1 Web Service.

The equivalent 9.0 JWS file is shown in "Equivalent 9.0 JWS File" on page 13-15. The differences between the 8.1 and 9.0 classes are shown in bold. Note that some of the JWS annotation values are taken from attributes of the 8.1 `servicegen` Ant task shown in "Example of an 8.1 and Updated 9.0 Ant Build File for an 8.1 EJB-Implemented Web Service" on page 13-16.

8.1 SessionBean Class

```
package examples.statelessSession;

import javax.ejb.CreateException;
import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

/**
 * HelloWorldBean is a stateless session EJB.  It has a single method,
 * sayHello(), that takes an integer and a String and returns a String.
 * <p>
 * The sayHello() method is the public operation of the Web service based on
 * this EJB.
```

```
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public class HelloWorldBean81 implements SessionBean {

  private static final boolean VERBOSE = true;
  private SessionContext ctx;

  // You might also consider using WebLogic's log service
  private void log(String s) {
    if (VERBOSE) System.out.println(s);
  }

  /**
   *   Single EJB business method.
   */
  public String sayHello(int num, String s) {

    System.out.println("sayHello in the HelloWorld EJB has "+
      "been invoked with arguments " + s + " and " + num);

    String returnValue = "This message brought to you by the "+
      "letter "+s+" and the number "+num;

    return returnValue;
  }

  /**
   * This method is required by the EJB Specification,
   * but is not used by this example.
   *
   */
  public void ejbActivate() {
    log("ejbActivate called");
  }

  /**
   * This method is required by the EJB Specification,
   * but is not used by this example.
   *
   */
  public void ejbRemove() {
    log("ejbRemove called");
  }

  /**
   * This method is required by the EJB Specification,
   * but is not used by this example.
   *
   */
```

```
  public void ejbPassivate() {
    log("ejbPassivate called");
  }

  /**
   * Sets the session context.
   *
   * @param ctx SessionContext Context for session
   */
  public void setSessionContext(SessionContext ctx) {
    log("setSessionContext called");
    this.ctx = ctx;
  }

  /**
   * This method is required by the EJB Specification,
   * but is not used by this example.
   *
   */
  public void ejbCreate () throws CreateException {
    log("ejbCreate called");
  }

}
```

8.1 Remote Interface

```
package examples.statelessSession;

import java.rmi.RemoteException;
import javax.ejb.EJBObject;

/**
 * The methods in this interface are the public face of HelloWorld.
 * The signatures of the methods are identical to those of the EJBean, except
 * that these methods throw a java.rmi.RemoteException.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public interface HelloWorld81 extends EJBObject {

  /**
   * Simply says hello from the EJB
   *
   * @param num                int number to return
   * @param s                  String string to return
   * @return                   String returnValue
   * @exception                RemoteException if there is
   *                           a communications or systems failure
```

```
   */
  String sayHello(int num, String s)
    throws RemoteException;
}
```

8.1 EJB Home Interface

```
package examples.statelessSession;

import java.rmi.RemoteException;
import javax.ejb.CreateException;
import javax.ejb.EJBHome;

/**
 * This interface is the Home interface of the HelloWorld stateless session EJB.
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */
public interface HelloWorldHome81 extends EJBHome {

  /**
   * This method corresponds to the ejbCreate method in the
   * HelloWorldBean81.java file.
   */
  HelloWorld81 create()
    throws CreateException, RemoteException;

}
```

Equivalent 9.0 JWS File

The differences between the 8.1 and 9.0 files are shown in bold. The value of some JWS annotations are taken from attributes of the 8.1 `servicegen` Ant task shown in "Example of an 8.1 and Updated 9.0 Ant Build File for an 8.1 EJB-Implemented Web Service" on page 13-16

```
package examples.webservices.upgrade_ejb;

// Import the standard JWS annotations

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;

// Import the WebLogic specific annotation

import weblogic.jws.WLHttpTransport;

// Class-level annotations
```

```
@WebService(name="HelloWorld90PortType", serviceName="HelloWorldService",
            targetNamespace="http://example.org")

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

@WLHttpTransport(contextPath="upgradeEJB", serviceUri="HelloWorldService",
                 portName="HelloWorld90Port")

/**
 * HelloWorld90Impl is the JWS equivalent of the HelloWorld81 EJB that
 * implemented the 8.1 Web Service.  It has a single method,
 * sayHello(), that takes an integer and a String and returns a String.
 * <p>
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

public class HelloWorld90Impl {

  /** the sayHello method will become the public operation of the Web
   *  Service.
   */

  @WebMethod()
  public String sayHello(int num, String s) {

    System.out.println("sayHello in the HelloWorld90 Web Service has "+
      "been invoked with arguments " + s + " and " + num);

    String returnValue = "This message brought to you by the "+
      "letter "+s+" and the number "+num;

    return returnValue;

  }

}
```

Example of an 8.1 and Updated 9.0 Ant Build File for an 8.1 EJB-Implemented Web Service

The following simple `build.xml` file shows the 8.1 way to build an EJB-implemented WebLogic Web Service using the `servicegen` Ant task. Following this example is an equivalent `build.xml` file that calls the `jwsc` Ant task to build a 9.0 Web Service.

```
<project name="ejb-webservice" default="all" basedir=".">
```

```
 <!-- set global properties for this build -->
 <property name="source" value="."/>
 <property name="build" value="${source}/build"/>
 <property name="ejb_file" value="HelloWorldWS.jar" />
 <property name="war_file" value="HelloWorldWS.war" />
 <property name="ear_file" value="HelloWorldApp.ear" />
 <property name="namespace" value="http://examples.org" />

 <target name="all" depends="clean,ear"/>

 <target name="clean">
   <delete dir="${build}"/>
 </target>

 <!-- example of old 8.1 servicegen call to build Web Service -->

 <target name="ejb">
   <delete dir="${build}" />
   <mkdir dir="${build}"/>
   <mkdir dir="${build}/META-INF"/>
   <copy todir="${build}/META-INF">
     <fileset dir="${source}">
       <include name="ejb-jar.xml"/>
     </fileset>
   </copy>
   <javac srcdir="${source}" includes="HelloWorld*.java"
          destdir="${build}" />
   <jar jarfile="${ejb_file}" basedir="${build}" />
   <wlappc source="${ejb_file}" />
 </target>

<target name="ear" depends="ejb">
  <servicegen
     destEar="${build}/${ear_file}"
     warName="${war_file}">
     <service
       ejbJar="${ejb_file}"
       targetNamespace="${namespace}"
       serviceName="HelloWorldService"
       serviceURI="/HelloWorldService"
       generateTypes="True"
```

```
          expandMethods="True">
        </service>
      </servicegen>
   </target>

</project>
```

An equivalent `build.xml` file that calls the `jwsc` Ant task to build a 9.0 Web Service is shown below, with the relevant tasks discussed in this section in bold:

```
<project name="webservices-upgrade_ejb" 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="upgradeEJB" />
  <property name="example-output" value="output" />
  <property name="ear-dir" value="${example-output}/upgradeEJB" />

  <taskdef name="jwsc"
    classname="weblogic.wsee.tools.anttasks.JwscTask" />

  <taskdef name="wldeploy"
    classname="weblogic.ant.taskdefs.management.WLDeploy"/>

  <target name="all" depends="clean,build-service,deploy" />

  <target name="clean" depends="undeploy">
    <delete dir="${example-output}"/>
  </target>

  <target name="build-service">

    <jwsc
      srcdir="src"
      destdir="${ear-dir}">

     <jws file="examples/webservices/upgrade_ejb/HelloWorld90Impl.java" />

    </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>

</project>
```

Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

The following table maps the attributes of the 8.1 `servicegen` Ant task to their equivalent 9.0 JWS annotation or `jwsc` attribute.

The attributes listed in the first column are a mixture of attributes of the main `servicegen` Ant task and attributes of the four child elements of `servicegen` (`<service>`, `<client>`, `<handlerChain>`, and `<security>`)

See Appendix B, "JWS Annotation Reference," and "jwsc" on page A-13 for more information about the 9.0 JWS annotations and `jwsc` Ant task.

.

Table 13-1 Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

servicegen or Child Element of servicegen Attribute	Equivalent JWS Annotation or jwsc Attribute
`contextURI`	`contextPath` attribute of the WebLogic-specific `@WLHttpTransport` annotation.
`destEAR`	`destdir` attribute of the `jwsc` Ant task.
`keepGenerated`	`keepGenerated` attribute of the `jwsc` Ant task.
`mergeWithExistingWS`	No equivalent.
`overwrite`	No equivalent.
`warName`	`name` attribute of the `<jws>` child element of the `jwsc` Ant task.
`ejbJAR` (attribute of the `service` child element)	No direct equivalent, because the `jwsc` Ant task generates Web Service artifacts from a JWS file, rather than a compiled EJB or Java class. Indirect equivalent is the `file` attribute of the `<jws>` child element of the `jwsc` Ant task that specifies the name of the JWS file.
`excludeEJBs` (attribute of the `service` child element)	No equivalent.
`expandMethods` (attribute of the `service` child element)	No equivalent.
`generateTypes` (attribute of the `service` child element)	No equivalent.
`ignoreAuthHeader` (attribute of the `service` child element)	No equivalent.

Table 13-1 Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

servicegen or Child Element of servicegen Attribute	Equivalent JWS Annotation or jwsc Attribute
`includeEJBs` (attribute of the `service` child element)	No equivalent.
`javaClassComponents` (attribute of the `service` child element)	No direct equivalent, because the `jwsc` Ant task generates Web Service artifacts from a JWS file, rather than a compiled EJB or Java class. Indirect equivalent is the `file` attribute of the `<jws>` child element of the `jwsc` Ant task that specifies the name of the JWS file.
`JMSAction` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.
`JMSConnectionFactory` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.
`JMSDestination` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.
`JMSDestinationType` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.
`JMSMessageType` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.
`JMSOperationName` (attribute of the `service` child element)	No equivalent because JMS-implemented Web Services are not supported in the 9.0 release.

Table 13-1 Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

servicegen or Child Element of servicegen Attribute	Equivalent JWS Annotation or jwsc Attribute
`protocol` (attribute of the `service` child element)	One of the following WebLogic-specific annotations: • `@WLHttpTransport` • `@WLHttpsTransport` • `@WLJmsTransport`
`serviceName` (attribute of the `service` child element)	`serviceName` attribute of the standard `@WebService` annotation.
`serviceURI` (attribute of the `service` child element)	`serviceUri` attribute of the WebLogic-specific `@WLHttpTransport`, `@WLHttpsTranport`, or `@WLJmsTransport` annotations.
`style` (attribute of `service` child element)	`style` attribute of the standard `@SOAPBinding` annoation.
`typeMappingFile` (attribute of the `service` child element)	No equivalent.
`targetNamespace` (attribute of the `service` child element)	`targetNamespace` attribute of the standard `@WebService` annotation.
`userSOAP12` (attribute of the `service` child element)	No equivalent.
`clientJarName` (attribute of `client` child element)	No equivalent.
`packageName` (attribute of the `client` child element)	No direct equivalent. Use the `packageName` attribute of the `clientgen` Ant task to generate client-side Java code and artifacts.
`saveWSDL` (attribute of the `client` child element)	No equivalent.

Table 13-1 Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

servicegen or Child Element of servicegen Attribute	Equivalent JWS Annotation or jwsc Attribute
`userServerTypes` (attribute of the `client` child element)	No equivalent.
`handlers` (attribute of the `handlerChain` child element)	Standard `@HandlerChain` or `@SOAPMessageHandlers` annotation.
`name` (attribute of the `handlerChain` child element)	Standard `@HandlerChain` or `@SOAPMessageHandlers` annotation.
`duplicateElimination` (attribute of the `reliability` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains Web Service reliable messaging policy assertions. See "Using Web Service Reliable Messaging" on page 6-1.
`persistDuration` (attribute of the `reliability` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains Web Service reliable messaging policy assertions. See "Using Web Service Reliable Messaging" on page 6-1.
`enablePasswordAuth` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2.
`encryptKeyName` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2

Table 13-1 Mapping of servicegen Attributes to JWS Annotations or jwsc Attributes

servicegen or Child Element of servicegen Attribute	Equivalent JWS Annotation or jwsc Attribute
`encryptKeyPass` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
`password` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
`signKeyName` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
`signKeyPass` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2
`username` (attribute of the `security` child element)	No direct equivalent. Use WebLogic-specific `@Policy` attribute to specify a WS-Policy file that contains message-level security policy assertions. See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2

Ant Task Reference

The following sections provide reference information about the WebLogic Web Services Ant tasks:

- "Overview of WebLogic Web Services Ant Tasks" on page A-1
- "clientgen" on page A-5
- "jwsc" on page A-13
- "wsdlc" on page A-28

For detailed information on how to integrate and use these Ant tasks in your development environment to program a Web Service and a client application that invokes the Web Service, see:

- "Iterative Development of WebLogic Web Services Starting From Java: Main Steps" on page 4-2
- "Iterative Development of WebLogic Web Services Starting From a WSDL File: Main Steps" on page 4-4
- Chapter 9, "Invoking Web Services"

Overview of WebLogic Web Services Ant Tasks

Ant is a Java-based build tool, similar to the `make` command but much more powerful. Ant uses XML-based configuration files (called `build.xml` by default) to execute tasks written in Java.

BEA provides a number of Ant tasks that help you generate important Web Service-related artifacts.

The Apache Web site provides other useful Ant tasks for packaging EAR, WAR, and EJB JAR files. For more information, see http://jakarta.apache.org/ant/manual/.

Note: The Apache Jakarta Web site publishes online documentation for only the most current version of Ant, which might be different from the version of Ant that is bundled with WebLogic Server. To determine the version of Ant that is bundled with WebLogic Server, run the following command after setting your WebLogic environment:

```
prompt> ant -version
```

To view the documentation for a specific version of Ant, download the Ant zip file from http://archive.apache.org/dist/ant/binaries/ and extract the documentation.

List of Web Services Ant Tasks

The following table provides an overview of the Web Service Ant tasks provided by BEA.

Table A-1 WebLogic Web Services Ant Tasks

Ant Task	Description
clientgen	Generates the JAX-RPC Service stubs and other client-side files used to invoke a Web Service.
jwsc	Compiles a *JWS*-annotated file into a Web Service. JWS refers to Java Web Service.
wsdlc	Generates a partial Web Service implementation based on a WSDL file.

Using the Web Services Ant Tasks

To use the Ant tasks:

1. Set your environment.

   On Windows NT, execute the `setDomainEnv.cmd` command, located in your domain directory. The default location of WebLogic Server domains is `*BEA_HOME*\user_projects\domains\*domainName*`, where *`BEA_HOME`* is the top-level installation directory of the BEA products and *`domainName`* is the name of your domain.

On UNIX, execute the `setDomainEnv.sh` command, located in your domain directory. The default location of WebLogic Server domains is `BEA_HOME/user_projects/domains/domainName`, where `BEA_HOME` is the top-level installation directory of the BEA products and `domainName` is the name of your domain.

2. Create a file called `build.xml` that will contain a call to the Web Services Ant tasks.

   The following example shows a simple `build.xml` file with a single target called `clean`:

```
<project name="my-webservice">

  <target name="clean">
     <delete>
       <fileset dir="tmp" />
     </delete>
  </target>

</project>
```

   This `clean` target deletes all files in the `temp` subdirectory.

   Later sections provide examples of specifying the Ant task in the `build.xml` file.

3. For each WebLogic Web Service Ant task you want to execute, add an appropriate task definition and target to the `build.xml` file using the `<taskdef>` and `<target>` elements. The following example shows how to add the `jwsc` Ant task to the build file; the attributes of the task have been removed for clarity:

```
  <taskdef name="jwsc"
      classname="weblogic.wsee.tools.anttasks.JwscTask" />

  <target name="build-service">
      <jwsc attributes go here...>
      ...
      </jwsc>
  </target>
```

   You can, of course, name the WebLogic Web Services Ant tasks anything you want by changing the value of the `name` attribute of the relevant `<taskdef>` element. For consistency, however, this document uses the names `jwsc`, `clientgen`, and `wsdlc` throughout.

4. Execute the Ant task or tasks specified in the `build.xml` file by typing `ant` in the same directory as the `build.xml` file and specifying the target:

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

Setting the Classpath for the WebLogic Ant Tasks

Each WebLogic Ant task accepts a `classpath` attribute or element so that you can add new directories or JAR files to your current CLASSPATH environment variable.

The following example shows how to use the `classpath` attribute of the `jwsc` Ant task to add a new directory to the CLASSPATH variable:

```
<jwsc srcdir="MyJWSFile.java"
      classpath="${java.class.path};my_fab_directory"
   ...
</jwsc>
```

The following example shows how to add to the CLASSPATH by using the `<classpath>` element:

```
<jwsc ...>
   <classpath>
       <pathelement path="${java.class.path}" />
       <pathelement path="my_fab_directory" />
   </classpath>
...
</jwsc>
```

The following example shows how you can build your CLASSPATH variable outside of the WebLogic Web Service Ant task declarations, then specify the variable from within the task using the `<classpath>` element:

```
<path id="myClassID">
   <pathelement path="${java.class.path}"/>
   <pathelement path="${additional.path1}"/>
   <pathelement path="${additional.path2}"/>
</path>

<jwsc ....>
   <classpath refid="myClassID" />
...
</jwsc>
```

Note: The Java Ant utility included in WebLogic Server uses the `ant` (UNIX) or `ant.bat` (Windows) configuration files in the *`WL_HOME`*`\server\bin` directory to set various Ant-specific variables, where *`WL_HOME`* is the top-level directory of your WebLogic Server installation If you need to update these Ant variables, make the relevant changes to the appropriate file for your operating system.

Differences in Operating System Case Sensitivity When Manipulating WSDL and XML Schema Files

Many WebLogic Web Service Ant tasks have attributes that you can use to specify a file, such as a WSDL or an XML Schema file.

The Ant tasks process these files in a case-sensitive way. This means that if, for example, the XML Schema file specifies two user-defined types whose names differ only in their capitalization (for example, `MyReturnType` and `MYRETURNTYPE`), the `clientgen` Ant task correctly generates two separate sets of Java source files for the Java representation of the user-defined data type: `MyReturnType.java` and `MYRETURNTYPE.java`.

However, compiling these source files into their respective class files might cause a problem if you are running the Ant task on Microsoft Windows, because Windows is a case *insensitive* operating system. This means that Windows considers the files `MyReturnType.java` and `MYRETURNTYPE.java` to have the same name. So when you compile the files on Windows, the second class file overwrites the first, and you end up with only one class file. The Ant tasks, however, expect that *two* classes were compiled, thus resulting in an error similar to the following:

```
c:\src\com\bea\order\MyReturnType.java:14:
class MYRETURNTYPE is public, should be declared in a file named
MYRETURNTYPE.java
public class MYRETURNTYPE
       ^
```

To work around this problem rewrite the XML Schema so that this type of naming conflict does not occur, or if that is not possible, run the Ant task on a case sensitive operating system, such as Unix.

clientgen

The `clientgen` Ant task generates, from an existing WSDL file, the client component files that client applications use to invoke both WebLogic and non-WebLogic Web Services. These files include:

- The Java source code for the JAX-RPC `Stub` and `Service` interface implementations for the particular Web Service you want to invoke.
- The Java source code for any user-defined XML Schema data types included in the WSDL file.
- The JAX-RPC mapping deployment descriptor file which contains information about the mapping between the Java user-defined data types and their corresponding XML Schema types in the WSDL file.
- A client-side copy of the WSDL file.

Two types of client applications use the generated artifacts of `clientgen` to invoke Web Services:

- Stand-alone Java clients that do not use the J2EE client container.
- J2EE clients, such as EJBs, JSPs, and Web Services, that use the J2EE client container.

Taskdef Classname

```
<taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />
```

Examples

```
<taskdef name="clientgen"
    classname="weblogic.wsee.tools.anttasks.ClientGenTask" />

...

<target name="build_client">

<clientgen
    wsdl="http://example.com/myapp/myservice.wsdl"
    destDir="/output/clientclasses"
    packageName="myapp.myservice.client"
    serviceName="StockQuoteService" />

<javac ... />

</target>
```

When the sample `build_client` target is executed, `clientgen` uses the WSDL file specified by the `wsdl` attribute to generate all the client-side artifacts needed to invoke the Web Service specified by the `serviceName` attribute. The `clientgen` Ant task generates all the artifacts into the `/output/clientclasses` directory. All generated Java code is in the `myapp.myservice.client` package. After `clientgen` has finished, the `javac` Ant task then compiles the Java code, both `clientgen`-generated as well as your own client application that uses the generated artifacts and contains your business code.

You typically execute the `clientgen` Ant task on a WSDL file that is deployed on the Web and accessed using HTTP. Sometimes, however, you might want to execute `clientgen` on a static WSDL file that is packaged in an archive file, such as the WAR or JAR file generated by the `jwsc` Ant task. In this case you must use the following syntax for the `wsdl` attribute:

```
wsdl="jar:file:archive_file!WSDL_file"
```

where *`archive_file`* refers to the full (or relative to the current directory) name of the archive file and *`WSDL_file`* refers to the full pathname of the WSDL file, relative to the root directory of the archive file. For example:

```
    <clientgen

wsdl="jar:file:output/myEAR/examples/webservices/simple/SimpleImpl.war!
/WEB-INF/SimpleService.wsdl"
      destDir="/output/clientclasses"
      packageName="myapp.myservice.client"/>
```

The preceding example shows how to execute `clientgen` on a static WSDL file called `SimpleService.wsdl`, which is packaged in the `WEB-INF` directory of a WAR file called `SimpleImpl.war`, which is located in the `output/myEAR/examples/webservices/simple` sub-directory of the directory that contains the `build.xml` file.

Attributes

The following table describes the attributes of the `clientgen` Ant task.

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
destDir	Directory into which the `clientgen` Ant task generates the client source code, WSDL, and client deployment descriptor files. You can set this attribute to any directory you want. However, if you are generating the client component files to invoke a Web Service from an EJB, JSP, or other Web Service, you typically set this attribute to the directory of the J2EE component which holds shared classes, such as `META-INF` for EJBs, `WEB-INF/classes` for Web Applications, or `APP-INF/classes` for Enterprise Applications. If you are invoking the Web Service from a stand-alone client, then you can generate the client component files into the same source code directory hierarchy as your client application code.	String	Yes.
generatePolicyMethods	Specifies whether the `clientgen` Ant task should include policy-loading methods in the generated JAX-RPC stubs. These methods can be used by client applications to load a local policy statement. If you specify `True`, four flavors of a method called `get`*`XXX`*`SoapPort()` are added as extensions to the JAX-RPC `Service` interface in the generated client stubs, where *`XXX`* refers to the name of the Web Service. Client applications can use these methods to load and apply local policy statements, rather than apply any policy statements deployed with the Web Service itself. Client applications can specify whether the local policy statement applies to inbound, outbound, or both SOAP messages and whether to load the local policy from an InputStream or a URI. Valid values for this attribute are `True` or `False`. The default value is `False`, which means the additional methods are *not* generated. See “Using a Client-Side Security WS-Policy File” on page 9-22 for more information.	Boolean	No.

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
generateAsyncMethods	Specifies whether the `clientgen` Ant task should include methods in the generated JAX-RPC stubs that client applications can use to invoke a Web Service operation asynchronously. For example, if you specify `True` (which is also the default value), and one of the Web Service operations in the WSDL is called `getQuote`, then the `clientgen` Ant task also generates a method called `getQuoteAsync` in the JAX-RPC stubs which client applications invoke instead of the original `getQuote` method. This asynchronous flavor of the operation also has an additional parameter, of data type `weblogic.wsee.async.AsyncPreCallContext`, that client applications can use to set asynchronous properties, contextual variables, and so on. See "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17 for full description and procedures about this feature. **Note:** If the Web Service operation is marked as one-way, the `clientgen` Ant task never generates the asynchronous flavor of the JAX-RPC stub, even if you explicitly set the `generateAsyncMethods` attribute to `True`. Valid values for this attribute are `True` or `False`. The default value is `True`, which means the asynchronous methods are generated by default.	Boolean	No.

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
overwrite	Specifies whether the client component files (source code, WSDL, and deployment descriptor files) generated by this Ant task should be overwritten if they already exist. If you specify `True`, new artifacts are always generated and any existing artifacts are overwritten. If you specify `False`, the Ant task overwrites only those artifacts that have changed, based on the timestamp of any existing artifacts. Valid values for this attribute is `True` or `False`. The default value is `True`.	Boolean	No.
packageName	Package name into which the generated JAX-RPC client interfaces and stub files are packaged. If you do not specify this attribute, the `clientgen` Ant task generates Java files whose package name is based on the targetNamespace of the WSDL file. For example, if the targetNamespace is `http://example.org`, then the package name might be `org.example` or something similar. If you want control over the package name, rather than let the Ant task generate one for you, then you should specify this attribute. If you do specify this attribute, BEA recommends you use all lower-case letters for the package name.	String	No.

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
serviceName	Name of the Web Service in the WSDL file for which the corresponding client component files should be generated. The Web Service name corresponds to the `<service>` element in the WSDL file. The generated JAX-RPC mapping file and client-side copy of the WSDL file will use this name. For example, if you set `serviceName` to `CuteService`, the JAX-RPC mapping file will be called `cuteService_java_wsdl_mapping.xml` and the client-side copy of the WSDL will be called `CuteService_saved_wsdl.wsdl`.	String	This attribute is required *only* if the WSDL file contains more than one `<service>` element. The Ant task returns an error if you do not specify this attribute and the WSDL file contains more than one `<service>` element.
wsdl	Full path name or URL of the WSDL that describes a Web Service (either WebLogic or non-WebLogic) for which the client component files should be generated. The generated stub factory classes in the client JAR file use the value of this attribute in the default constructor.	String	Yes.

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
autoDetectWrapped	Specifies whether the `clientgen` Ant task should try to determine whether the parameters and return type of document-literal Web Services are of type *wrapped* or *bare*. When the `clientgen` Ant task parses a WSDL file to create the JAX-RPC stubs, it attempts to determine whether a document-literal Web Service uses wrapped or bare parameters and return types based on the names of the XML Schema elements, the name of the operations and parameters, and so on. Depending on how the names of these components match up, the `clientgen` Ant task makes a best guess as to whether the parameters are wrapped or bare. In some cases, however, you might want the Ant task to *always* assume that the parameters are of type bare; in this case, set the `autoDetectWrapped` attribute to `False`. Valid values for this attribute are `True` or `False`. The default value is `True`.	Boolean	No.
handlerChainFile	Specifies the name of the XML file that describes the client-side SOAP message handlers that execute when a client application invokes a Web Service. Each handler specified in the file 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 If you do not specify this clientgen attribute, then no client-side handlers execute, even if they are in your CLASSPATH. See "Creating and Using Client-Side SOAP Message Handlers" on page 9-17 for details and examples about creating client-side SOAP message handlers.	String	No

Table A-2 Attributes of the clientgen Ant Task

Attribute	Description	Data Type	Required?
jaxRPCWrappedArraySt yle	When the `clientgen` Ant task is generating the Java equivalent to XML Schema data types in the WSDL file, and the task encounters an XML complex type with a single enclosing sequence with a single element with the `maxOccurs` attribute equal to `unbounded`, the task generates, by default, a Java structure whose name is the lowest named enclosing complex type or element. To change this behavior so that the task generates a literal array instead, set the `jaxRPCWrappedArrayStyle` to `False`. Valid values for this attribute are `True` or `False`. The default value is `True`.	Boolean	No.
classpath	Additions to the CLASSPATH. Use this attribute to add JAR files or directories that contain Java classes to the CLASSPATH used to compile the JWS file.	String	No.
classpathref	Additions to the CLASSPATH, but specified as a reference to a path defined elsewhere in the `build.xml` file.	String	No

jwsc

The `jwsc` Ant task takes as input a Java Web Service (JWS) file that contains both standard (JSR-181) and WebLogic-specific JWS annotations and generates all the artifacts you need to create a WebLogic Web Service. The generated artifacts include:

- Java source files that implement a standard JSR-921 Web Service, such as the service endpoint interface (called *`JWS_ClassName`*`PortType.java`, where *`JWS_ClassName`* refers to the JWS class).
- All required deployment descriptors. In addition to the standard `webservices.xml` and JAX-RPC mapping files, the `jwsc` Ant task also generates the WebLogic-specific Web Services deployment descriptor (`weblogic-webservices.xml`).
- The XML Schema representation of any Java user-defined types used as parameters or return values to the methods of the JWS files that are specified to be exposed as public operations.

- The WSDL file that publicly describes the Web Service.

After generating all the artifacts, the `jwsc` Ant task compiles the Java and JWS files, 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. You then deploy this Enterprise Application to WebLogic Server. If you specify an existing Enterprise Application as the destination directory to `jwsc`, the Ant task updates any existing `application.xml` file with the new Web Services information.

Note: The `jwsc` Ant task typically generates a Java class-implemented Web Service from the specified JWS file and packages it into a Web Application WAR file. In the following cases, however, it creates a stateless session EJB-implemented Web Service and packages it into an EJB JAR file:

- The JWS file specifies any of the following JWS annotations: `weblogic.jws.Conversation`; `weblogic.jws.Conversational`; `weblogic.jws.ServiceClient`.
- The JWS file uses any EJBGen annotation.
- The JWS file explicitly implements `javax.ejb.SessionBean`.

You invoke and use Java class- and stateless session EJB-implemented Web Services in exactly the same way, so this implementation detail is typically not important to a programmer. It is mentioned in this section only for the case in which a programmer needs to update the Web Service archive and needs to know if it is a WAR or an EJB JAR.

You specify the JWS file you want the `jwsc` Ant task to compile using the `<jws>` child-element of the Ant task. The `<jws>` element includes three optional child-elements for specifying the transports (HTTP/S or JMS) that are used to invoke the Web Service.

See "Creating a Web Service With User-Defined Data Types" on page 3-7 for a complete example of using the `jwsc` Ant task.

Taskdef Classname

```
<taskdef name="jwsc"
      classname="weblogic.wsee.tools.anttasks.JwscTask" />
```

Examples

The following examples show how to use the `jwsc` Ant task by including it in a `build-service` target of the `build.xml` Ant file that iteratively develops your Web Service. See Chapter 3, "Common Web Services Use Cases and Examples," and Chapter 4, "Iterative Development of

WebLogic Web Services," for samples of complete `build.xml` files that contain many other targets that are useful when iteratively developing a WebLogic Web Service, such as `clean`, `deploy`, `client`, and `run`.

The following sample shows a very simple usage of `jwsc`:

```
<target name="build-service">
  <jwsc
    srcdir="src"
    destdir="output/TestEar">
    <jws file="examples/webservices/test/TestServiceImpl.java" />
  </jwsc>
</target>
```

In the example, the JWS file called `TestServiceImpl.java` is located in the `src/examples/webservices/test` sub-directory of the directory that contains the `build.xml` file. The `jwsc` Ant task generates the Web Service artifacts in the `output/TestEar` sub-directory. In addition to the Web Service JAR file, the `jwsc` Ant task also generates the `application.xml` file that describes the Enterprise Application in the `output/TestEar/META-INF` directory.

The following example shows a more complicated use of `jwsc`:

```
  <path id="add.class.path">
    <pathelement path="${myclasses-dir}"/>
    <pathelement path="${java.class.path}"/>
  </path>
...
  <target name="build-service2">
    <jwsc
      srcdir="src" destdir="output/TestEar"
      verbose="on" debug="on"
      keepGenerated="yes"
      classpathref="add.class.path">
      <jws file="examples/webservices/test/TestServiceImpl.java" />
      <jws file="examples/webservices/test/AnotherTestServiceImpl.java"/>
      <jws file="examples/webservices/test/SecondTestServiceImpl.java" />
    </jwsc>
  </target>
```

The example shows how to enable debugging and verbose output, and how to specify that jwsc not regenerate any existing temporary files in the output directory. The example shows how to use classpathref attribute to add to the standard CLASSPATH by referencing a path called add.class.path that has been specified elsewhere in the build.xml file using the standard Ant <path> target.

The example also shows how to specify multiple JWS files, resulting in separate Web Services packaged in their own JAR files, although all are still deployed as part of the same Enterprise Application.

The following example shows how to specify the transport that is used to invoke the Web Service:

```
<target name="build-service3">
  <jwsc
    srcdir="src"
    destdir="output/TestEar">
    <jws file="examples/webservices/test/TestServiceImpl.java">
      <WLHttpTransport
              contextPath="TestService" serviceUri="TestService"
              portName="TestServicePort1"/>
    </jws>
  </jwsc>
</target>
```

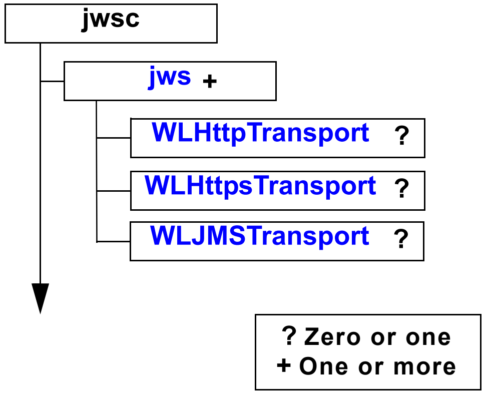
The preceding example shows how to specify that the HTTP transport is used to invoke the Web Service.

Attributes and Child Elements of the jwsc Ant Task

The jwsc Ant task has a variety of attributes and one child element: <jws>. The <jws> element has three optional child elements: <WLHttpTransport>, <WLHttpsTransport>, and <WLJMSTransport>. See “Transport Child Elements” on page A-23 for common information about using the transport elements.

The following graphic describes the hierarchy of the jwsc Ant task.

Figure A-1 Element Hierarchy of jwsc Ant Task



The following table describes the attributes of the main `jwsc` Ant task.

Table A-3 Attributes of the jwsc Ant Task

Attribute	Description	Required?
destdir	The full pathname of the directory that will contain the compiled JWS files, XML Schemas, WSDL, and generated deployment descriptor files, all packaged into a JAR or WAR file. The `jwsc` Ant task creates an exploded Enterprise Application at the specified directory, or updates one if you point to an existing application directory. The jwsc task generates the JAR or WAR file that implements the Web Service in this directory, as well as other needed files, such as the `application.xml` file in the `META-INF` directory; the `jwsc` Ant task updates an existing `application.xml` file if it finds one, or creates a new one if not. Use the `applicationXML` attribute to specify a different `application.xml` from the default.	Yes.
keepGenerated	Specifies whether the Java source files and artifacts generated by this Ant task should be regenerated if they already exist. If you specify `no`, new Java source files and artifacts are always generated and any existing artifacts are overwritten. If you specify `yes`, the Ant task regenerates only those artifacts that have changed, based on the timestamp of any existing artifacts. Valid values for this attribute are `yes` or `no`. The default value is `no`.	No.

Table A-3 Attributes of the jwsc Ant Task

Attribute	Description	Required?
sourcepath	The full pathname of top-level directory that contains the Java files referenced by the JWS file, such as JavaBeans used as parameters or user-defined exceptions. The Java files are in sub-directories of the sourcepath directory that correspond to their package names. The `sourcepath` pathname can be either absolute or relative to the directory which contains the Ant `build.xml` file. For example, if `sourcepath` is `/src` and the JWS file references a JavaBean called `MyType.java` which is in the `webservices.financial` package, then this implies that the `MyType.java` Java file is stored in the `/src/webservices/financial` directory. The default value of this attribute is the value of the `srcdir` attribute. This means that, by default, the JWS file and the objects it references are in the same package. If this is not the case, then you should specify the `sourcepath` accordingly.	No.
enableAsyncService	Specifies whether the Web Service is using one or more of the asynchronous features of WebLogic Web Service: Web Service reliable messaging, asynchronous request-response, buffering, or conversations. In the case of Web Service reliable messaging, you must ensure that this attribute is enabled for both the reliable Web Service and the Web Service that is invoking the operations reliably. In the case of the other features (conversations, asynchronous request-response, and buffering), the attribute must be enabled only on the client Web Service. When this attribute is set to `true` (default value), WebLogic Server automatically deploys internal modules that handle the asynchronous Web Service features. Therefore, if you are not using any of these features in your Web Service, consider setting this attribute to `false` so that WebLogic Server does not waste resources by deploying unneeded internal modules. Valid values for this attribute are `true` and `false`. The default value is `true`.	No.
verbose	Enables verbose output for debugging purposes. Valid values for this attribute are `on` or `off`. The default value is `off`, which means verbose output is not enabled.	No.

Table A-3 Attributes of the jwsc Ant Task

Attribute	Description	Required?
srcdir	The full pathname of top-level directory that contains the JWS file you want to compile (specified with the `file` attribute of the `<jws>` child element). The JWS file is in sub-directories of the `srcdir` directory that corresponds to its package name. The `srcdir` pathname can be either absolute or relative to the directory which contains the Ant `build.xml` file. For example, if `srcdir` is `/src` and the JWS file called `MyService.java` is in the `webservices.financial` package, then this implies that the `MyService.java` JWS file is stored in the `/src/webservices/financial` directory.	Yes.
classpath	Additions to the CLASSPATH. Use this attribute to add JAR files or directories that contain Java classes to the CLASSPATH used to compile the JWS file.	No.
classpathref	Additions to the CLASSPATH, but specified as a reference to a path defined elsewhere in the `build.xml` file.	No.
sourcepathref	Additions to the sourcepath, but specified as a reference to a path defined elsewhere in the `build.xml` file.	No.
nowarn	Specifies whether the compiler should print warning messages or not. Valid values for this attribute are `off` or `on`. The default value is `off`, which means that warnings *are* printed.	No.
debug	Specifies whether the jwsc Ant task should print debugging information as it compiles your JWS file. Valid values for this attribute are `on` or `off`. The default value is `off`.	No.
optimize	Specifies whether optimization is enabled when compiling JWS files. Valid values for this attribute are `on` or `off`. The default value is `off`.	No.
includeAntRuntime	Specifies whether to include the Ant runtime libraries in the CLASSPATH. Valid values for this attribute are `yes` or `no`. The default value is `yes`.	No.
includeJavaRuntime	Specifies whether to include the default runtime libraries of the Java Virtual Machine which is executing the Ant task in the CLASSPATH. Valid values for this attribute are `yes` or `no`. The default value is `no`.	No.

Table A-3 Attributes of the jwsc Ant Task

Attribute	Description	Required?
fork	Specifies whether the jwsc Ant task is executed using the JDK compiler externally. Valid values for this attribute are `yes` and `no`. The default value is `no`.	No.
failonerror	Specifies whether the compilation of the JWS file should continue, even if errors are encountered. Valid values for this attribute are `true` and `false`. The default value is `true`.	No.
tempdir	Specifies the name of the directory that will contain any temporary files used by jwsc. This attribute is useful if the compilation of JWS files is failing due to excessively long path names, in particular on Microsoft Windows operating systems. The default value of this attribute is the value of the `java.io.tmpdir` System property.	No.
deprecation	Specifies whether information about deprecated classes in both the JWS file and generated Java classes should be enabled when compiling the JWS file. Valid values for this attribute are `on` and `off`. The default value is `off`.	No.
applicationXml	Specifies the full name and path of the `application.xml` deployment descriptor of the Enterprise Application. If you specify an existing file, the `jwsc` Ant task updates it to include the Web Services information. If the file does not exist, `jwsc` creates it. The jwsc Ant task also creates or updates the corresponding `weblogic-application.xml` file in the same directory. If you do not specify this attribute, `jwsc` creates or updates the file *`destDir`*`/META-INF/application.xml`, where *`destDir`* is the *`jwsc`* attribute.	No

Table A-3 Attributes of the jwsc Ant Task

Attribute	Description	Required?
srcEncoding	Specifies the character encoding of the input files, such as the JWS file or configuration XML files. Examples of character encodings are SHIFT-JIS and UTF-8. The default value of this attribute is the character encoding set for the JVM.	No.
destEncoding	Specifies the character encoding of the output files, such as the deployment descriptors and XML files. Examples of character encodings are SHIFT-JIS and UTF-8. The default value of this attribute is UTF-8.	No.

jws

The `<jws>` child element of the `jwsc` Ant task specifies the name of a JWS file that implements your Web Service and for which the Ant task should generate Java code and supporting artifacts and then package into a deployable JAR file inside of an Enterprise Application.

You must specify at least one `<jws>` element. If you specify more than one, the `jwsc` Ant task generates a separate Web Service for each JWS file, each of which is packaged in its own JAR file.

The following table describes the attributes of the `<jws>` child element of the `jwsc` Ant task.

Table A-4 Attributes of the <jws> Child Element of the jwsc Ant Task

Attribute	Description	Required?
file	The name of the JWS file that you want to compile. The `jwsc` Ant task looks for the file in the `srcdir` directory.	Yes.
explode	Specifies whether the generated JAR file which contains the deployable Web Service is in exploded directory format or not. Valid values for this attribute are `true` or `false`. Default value is `false`, which means that the generated JAR file is archived in a JAR and not in an exploded directory format.	No.

Table A-4 Attributes of the <jws> Child Element of the jwsc Ant Task

Attribute	Description	Required?
name	The name of the generated JAR file (or exploded directory, if the `explode` attribute is set to `true`) that contains the deployable Web Service. If an actual JAR archive file is generated, the name of the file will also have a `.jar` or `.war` extension (depending on whether `jwsc` generates an EJB or Java class implementation.) The default value of this attribute is the name of the JWS file, specified by the `file` attribute.	No.

includeSchemas	The full pathname of the XML Schema file that describes a `com.bea.xml.XMLBeans` parameter or return value of the Web Service.
	
	To specify more than one XML Schema file, use either a comma or semi-colon as a delimiter:
	
	`includeSchemas="po.xsd,customer.xsd"`
	
	This attribute is *only* supported in the case where the JWS file explicitly uses an `com.bea.xml.XMLBeans` data type as a parameter or return value of a Web Service operation. If you are not using the `XMLBeans` data type, the `jwsc` Ant task returns an error if you specify this attribute.
	
	Additionally, you can use this attribute only for Web Services whose SOAP binding is document-literal-bare. Because the default SOAP binding of a WebLogic Web Service is document-literal-wrapped, the corresponding JWS file must include the following JWS annotation:
	
	`@SOAPBinding(`
	` style=SOAPBinding.Style.DOCUMENT,`
	` use=SOAPBinding.Use.LITERAL,`
	` parameterStyle=SOAPBinding.ParameterStyle.BARE)`
	
	For more information on `XMLBeans`, see http://dev2dev.bea.com/technologies/xmlbeans/index.jsp.
		Required if you are using an `XMLBeans` data type as a parameter or return value.

Table A-4 Attributes of the <jws> Child Element of the jwsc Ant Task

Attribute	Description	Required?
compiledWsdl	Full pathname of the JAR file generated by the `wsdlc` Ant task based on an existing WSDL file. The JAR file contains the JWS interface file that implements a Web Service based on this WSDL, as well as data binding artifacts for converting parameter and return value data between its Java and XML representations; the XML Schema section of the WSDL defines the XML representation of the data. You use this attribute *only* in the "starting from WSDL" use case, in which you first use the wsdlc Ant task to generate the JAR file, along with the JWS file that implements the generated JWS interface. After you update the JWS implementation class with business logic, you run the `jwsc` Ant task to generate a deployable Web Service, using the `file` attribute to specify this updated JWS implementation file. You do not use the `compiledWsdl` attribute for the "starting from Java" use case in which you write your JWS file from scratch and the WSDL file that describes the Web Service is generated by the WebLogic Web Services runtime.	Only required for the "starting from WSDL" use case.
wsdlOnly	Specifies that *only* a WSDL file should be generated for this JWS file. **Note:** Although the other artifacts, such as the deployment descriptors and service endpoint interface, are not generated, data binding artifacts *are* generated because the WSDL must include the XML Schema that describes the data types of the parameters and return values of the Web Service operations. The WSDL is generated into the `destDir` directory. The name of the file is *`JWS_ClassName`*`Service.wsdl`, where *`JWS_ClassName`* refers to the name of the JWS class. *`JWS_ClassNameService`* is also the name of Web Service in the generated WSDL file. Valid values for this attribute are `true` or `false`. The default value is `false`, which means that all artifacts are generated by default, not just the WSDL file.	No.

Transport Child Elements

When you program your JWS file, you can use an annotation to specify the transport that clients use to invoke the Web Service, in particular `@weblogic.jws.WLHttpTransport`, `@weblogic.jws.WLHttpsTransport`, or `@weblogic.jws.WLJMSTransport`. You can specify only *one* of these annotations in the JWS file. However, a programmer might not know at the time that they are coding the JWS file which transports best suits their needs. For this reason, it is best to specify the transport at build-time with one of the following transport child-elements of the `<jws>` element:

- "WLHttpTransport" on page A-24
- "WLHttpsTransport" on page A-25
- "WLJMSTransport" on page A-27

You can specify exactly zero or one of the preceding transport elements for a particular JWS file. 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. Finally, whatever transport you specify to `jwsc` overrides any transport annotation in the JWS file.

WLHttpTransport

Use the `WLHttpTransport` element to specify the context path and service URI sections of the URL used to invoke the Web Service over the HTTP transport, as well as the name of the port in the generated WSDL.

See "Transport Child Elements" on page A-23 for guidelines to follow when specifying this element.

The following table describes the attributes of the `<WLHttpTransport>` child element of the `<jws>` element.

Table A-5 Attributes of the <WLHttpTransport> Child Element of the <jws> Element

Attribute	Description	Required?
contextPath	Context root of the Web Service. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The contextPath for this Web Service is `financial`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its contextPath is `HelloWorldImpl`.	No.
serviceUri	Web Service URI portion of the URL. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The serviceUri for this Web Service is `GetQuote`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its serviceUri is `HelloWorldImpl`.	No.
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. The default value of this attribute is based on the `@javax.jws.WebService` annotation of the JWS file. In particular, the default `portName` is the value of the `name` attribute of `@WebService` annotation, plus the actual text `SoapPort`. For example, if `@WebService.name` is set to `MyService`, then the default portName is `MyServiceSoapPort`.	No.

WLHttpsTransport

Use the `WLHttpsTransport` element to specify the context path and service URI sections of the URL used to invoke the Web Service over the secure HTTPS transport, as well as the name of the port in the generated WSDL.

See "Transport Child Elements" on page A-23 for guidelines to follow when specifying this element.

The following table describes the attributes of the `<WLHttpsTransport>` child element of the `<jws>` element.

Table A-6 Attributes of the <WLHttpsTransport> Child Element of the <jws> Element

Attribute	Description	Required?
contextPath	Context root of the Web Service. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `https://hostname:7001/financial/GetQuote?WSDL` The contextPath for this Web Service is `financial`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its contextPath is `HelloWorldImpl`.	No.
serviceUri	Web Service URI portion of the URL. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `https://hostname:7001/financial/GetQuote?WSDL` The serviceUri for this Web Service is `GetQuote`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its serviceUri is `HelloWorldImpl`.	No.
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. The default value of this attribute is based on the `@javax.jws.WebService` annotation of the JWS file. In particular, the default portName is the value of the `name` attribute of `@WebService` annotation, plus the actual text `SoapPort`. For example, if `@WebService.name` is set to `MyService`, then the default portName is `MyServiceSoapPort`.	No.

WLJMSTransport

Use the WLJMSTransport element to specify the context path and service URI sections of the URL used to invoke the Web Service over the JMS transport, as well as the name of the port in the generated WSDL. You also specify the name of the JMS queue and connection factory that you have already configured for JMS transport.

See "Transport Child Elements" on page A-23 for guidelines to follow when specifying this element.

The following table describes the attributes of the <WLJMSTransport> child element of the <jws> element.

Table A-7 Attributes of the <WLJMSTransport> Child Element of the <jws> Element

Attribute	Description	Required?
contextPath	Context root of the Web Service. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The contextPath for this Web Service is `financial`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its contextPath is `HelloWorldImpl`.	No.
serviceUri	Web Service URI portion of the URL. For example, assume the deployed WSDL of a WebLogic Web Service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The serviceUri for this Web Service is `GetQuote`. The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its serviceUri is `HelloWorldImpl`.	No

Table A-7 Attributes of the <WLJMSTransport> Child Element of the <jws> Element

Attribute	Description	Required?
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. The default value of this attribute is based on the `@javax.jws.WebService` annotation of the JWS file. In particular, the default portName is the value of the `name` attribute of `@WebService` annotation, plus the actual text `SoapPort`. For example, if `@WebService.name` is set to `MyService`, then the default portName is `MyServiceSoapPort`.	No.
queue	The JNDI name of the JMS queue that you have configured for the JMS transport. See "Using JMS Transport as the Connection Protocol" on page 7-1 for details about using JMS transport. The default value of this attribute, if you do not specify it, is `weblogic.wsee.DefaultQueue`. You must still create this JMS queue in the WebLogic Server instance to which you deploy your Web Service.	No.

wsdlc

The `wsdlc` Ant task generates, 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. In particular, the Ant task generates:

- A JWS interface file that implements the Web Service described by the WSDL file. The interface includes full method signatures that implement the Web Service operations, and JWS annotations (such as `@WebService` and `@SOAPBinding`) that implement other aspects of the Web Service.

  The `wsdlc` Ant task generates artifacts for the *first* `<service>` element it finds in the WSDL file. You can specify a specific WSDL `<binding>` by using the `srcBindingName` attribute.

  Warning: The JWS interface is generated into a JAR file, neither of which you should ever update. It is discussed in this section only because later you need to specify this JAR file to the `jwsc` Ant task when you compile your JWS implementation file into a Web Service.

- Data binding artifacts used by WebLogic Server to convert between the XML and Java representations of the Web Service parameters and return values. The XML Schema of the data types is specified in the WSDL, and the Java representation is generated by the `wsdlc` Ant task.

Warning: These artifacts are generated into a JAR file, along with the JWS interface file, none of which you should ever update. It is discussed in this section only because later you need to specify this JAR file to the `jwsc` Ant task when you compile your JWS implementation file into a Web Service.

- A JWS file that contains a stubbed-out implementation of the generated JWS interface.
- Optional Javadocs for the generated JWS interface.

After running the `wsdlc` Ant task, (which typically you only do once) you update the generated JWS implementation file, in particular by adding Java code to the methods so that they function as you want. The generated JWS implementation file does not initially contain any business logic because the `wsdlc` Ant task obviously 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.

When you code the JWS implementation file, you can also add additional JWS annotations, although you must abide by the following rules:

- The *only* standard JSR-181 JWS annotations you can include in the JWS implementation file are `@WebService`, `@HandlerChain`, `@SOAPMessageHandler`, and `@SOAPMessageHandlers`. If you specify any other JWS-181 JWS annotations, the `jwsc` Ant task will return an error when you try to compile the JWS file into a Web Service.
- Additionally, you can specify *only* the `serviceName` and `endpointInterface` attributes of the `@WebService` annotation. Use the `serviceName` attribute to specify 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 interface generated by the `wsdlc` Ant task.
- You can specify any WebLogic-specific JWS annotation that you want.

Finally, after you have coded the JWS file so that it works as you want, iteratively 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.

Note: The only potential difference between the original and deployed WSDL is the value of the `location` attribute of the `<address>` element of the port(s) of the Web Service. The deployed WSDL will specify the actual hostname and URI of the deployed Web Service, which is most likely different from that of the original WSDL. This difference is to be expected when deploying a real Web Service based on a static WSDL.

See "Creating a Web Service from a WSDL File" on page 3-14 for a complete example of using the `wsdlc` Ant task in conjunction with `jwsc`.

Taskdef Classname

```
<taskdef name="wsdlc"
       classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>
```

Example

The following excerpt from an Ant `build.xml` file shows how to use the `wsdlc` and `jwsc` Ant tasks together to build a WebLogic Web Service. The build file includes two different targets: `generate-from-wsdl` that runs the `wsdlc` Ant task against an existing WSDL file, and `build-service` that runs the `jwsc` Ant task to build a deployable Web Service from the artifacts generated by the `wsdlc` Ant task:

```
<taskdef name="wsdlc"
         classname="weblogic.wsee.tools.anttasks.WsdlcTask"/>

<taskdef name="jwsc"
  classname="weblogic.wsee.tools.anttasks.JwscTask" />

<target name="generate-from-wsdl">

  <wsdlc
      srcWsdl="wsdl_files/TemperatureService.wsdl"
      destJwsDir="output/compiledWsdl"
      destImplDir="output/impl"
      packageName="examples.webservices.wsdlc" />

</target>

<target name="build-service">

  <jwsc
    srcdir="src"
    destdir="output/wsdlcEar">

    <jws file="examples/webservices/wsdlc/TemperaturePortTypeImpl.java"
       compiledWsdl="output/compiledWsdl/TemperatureService_wsdl.jar" />
```

```
    </jwsc>
  </target>
```

In the example, the wsdlc Ant task takes as input the TemperatureService.wsdl file and generates the JAR file that contains the JWS interface and data binding artifacts into the directory output/compiledWsdl. The name of the JAR file is TemperatureService_wsdl.jar. The Ant task also generates a JWS file that contains a stubbed-out implementation of the JWS interface into the output/impl/examples/webservices/wsdlc directory (a combination of the value of the destImplDir attribute and the directory hierarchy corresponding to the specified packageName). The name of the stubbed-out JWS implementation file is based on the name of the <portType> element in the WSDL file that corresponds to the first <service> element. For example, if the portType name is TemperaturePortType, then the generated JWS implementation file is called TemperaturePortTypeImpl.java.

After running wsdlc, you code the stubbed-out JWS implementation file, adding your business logic. Typically, you move this JWS file from the wsdlc-output directory to a more permanent directory that contains your application source code; in the example, the fully coded TemperaturePortTypeImpl.java JWS file has been moved to the directory src/examples/webservices/wsdlc/. You then run the jwsc Ant task, specifying this JWS file as usual. The only additional attribute you must specify is compiledWsdl to point to the JAR file generated by the wsdlc Ant task, as shown in the preceding example. This indicates that you do not want the jwsc Ant task to generate a new WSDL file, because you want to use the original one that has been compiled into the JAR file.

Attributes

The following table describes the attributes of the `wsdlc` Ant task.

Table A-8 Attributes of the wsdlc Ant Task

Attribute	Description	Data Type	Required?
srcWsdl	Name of the WSDL from which to generate the JAR file that contains the JWS interface and data binding artifacts. The name must include its pathname, either absolute or relative to the directory which contains the Ant `build.xml` file.	String	Yes.
srcBindingName	Name of the WSDL binding from which the JWS interface file should be generated. The `wsdlc` Ant task runs against the first `<service>` element it finds in the WSDL file. Therefore, you only need to specify the `srcBindingName` attribute if there is *more* than one `<binding>` element associated with this first `<service>` element.	String.	Only if the WSDL file contains more than one `<binding>` element
packageName	Package into which the generated JWS interface 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.	String	No.
destJwsDir	Directory into which the JAR file that contains the JWS interface 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`.	String	Yes.

Table A-8 Attributes of the wsdlc Ant Task

Attribute	Description	Data Type	Required?
desImplDir	Directory into which the stubbed-out JWS implementation file is generated. The generated JWS file implements the generated JWS interface file (contained within the JAR file). You update this JWS implementation file, adding Java code to the methods so that they behave as you want, then later specify this updated JWS file to the `jwsc` Ant task to generate a deployable Web Service.	String	No.
destJavadocDir	Directory into which Javadoc that describes the JWS interface is generated. Because you should never unjar or update the generated JAR file that contains the JWS interface file that implements the specified Web Service, you can get detailed information about the interface file from this generated Javadoc. You can then use this documentation, together with the generated stubbed-out JWS implementation file, to add business logic to the partially generated Web Service.	String	No.

Table A-8 Attributes of the wsdlc Ant Task

Attribute	Description	Data Type	Required?
autoDetectWrapped	Specifies whether the `wsdlc` Ant task should try to determine whether the parameters and return type of document-literal Web Services are of type *wrapped* or *bare*. When the `wsdlc` Ant task parses a WSDL file to create the partial JWS file that implements the Web Service, it attempts to determine whether a document-literal Web Service uses wrapped or bare parameters and return types based on the names of the XML Schema elements, the name of the operations and parameters, and so on. Depending on how the names of these components match up, the `wsdlc` Ant task makes a best guess as to whether the parameters are wrapped or bare. In some cases, however, you might want the Ant task to *always* assume that the parameters are of type bare; in this case, set the `autoDetectWrapped` attribute to `False`. Valid values for this attribute are `True` or `False`. The default value is `True`.	Boolean	No.
jaxRPCWrappedArrayStyle	When the `wsdlc` Ant task is generating the Java equivalent to XML Schema data types in the WSDL file, and the task encounters an XML complex type with a single enclosing sequence with a single element with the `maxOccurs` attribute equal to `unbounded`, the task generates, by default, a Java structure whose name is the lowest named enclosing complex type or element. To change this behavior so that the task generates a literal array instead, set the `jaxRPCWrappedArrayStyle` to `False`. Valid values for this attribute are `True` or `False`. The default value is `True`.	Boolean	No.

JWS Annotation Reference

The following sections provide reference documentation about standard (JSR-181) and WebLogic-specific JWS annotations:

- "Overview of JWS Annotation Tags" on page B-1
- "Standard JSR-181 JWS Annotations Reference" on page B-3
- "WebLogic-Specific JWS Annotations Reference" on page B-15

Overview of JWS Annotation Tags

The WebLogic Web Services programming model uses the new JDK 5.0 metadata annotations feature (specified by JSR-175). In this programming model, you create an annotated Java file and then use Ant tasks to compile the file into the Java source code 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 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) as well as a set of WebLogic-specific ones. This chapter provides reference information about both of these set of annotations.

You can target a JWS annotation at either the class-, method- or parameter-level in a JWS file. Some annotations can be targeted at more than one level, such as `@SecurityRoles` that can be targeted at both the class- and method-level. The documentation in this section lists the level to which you can target each annotation.

The following example shows a simple JWS file that uses both standard JSR-181 and WebLogic-specific JWS annotations, shown in bold:

```
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 WebLogic-specific JWS annotation interface

import weblogic.jws.WLHttpTransport;

// 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,
             use=SOAPBinding.Use.LITERAL,
             parameterStyle=SOAPBinding.ParameterStyle.WRAPPED)

// WebLogic-specific JWS annotation that specifies the context path and service
// URI used to build the URI of the Web Service is "complex/ComplexService"

@WLHttpTransport(contextPath="complex", serviceUri="ComplexService",
                 portName="ComplexServicePort")

/**
 * This JWS file forms the basis of a WebLogic Web Service.  The Web Services
 * has 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.
```

```
 *
 * @author Copyright (c) 2005 by BEA Systems. All Rights Reserved.
 */

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;
  }
}
```

Standard JSR-181 JWS Annotations Reference

The Web Services Metadata for the Java Platform (JSR-181) specification defines the standard annotations you can use in your JWS file to specify the shape and behavior of your Web Service.

This section briefly describes each annotation, along with its attributes. See Chapter 5, "Programming the JWS File," for examples. For more detailed information about the annotations, such as the Java annotation type definition and additional examples, see the specification.

This section documents the following standard JWS annotations:

- javax.jws.WebService
- javax.jws.WebMethod
- javax.jws.Oneway
- javax.jws.WebParam
- javax.jws.WebResult
- javax.jws.HandlerChain
- javax.jws.soap.SOAPBinding
- javax.jws.soap.SOAPMessageHandler
- javax.jws.soap.InitParam
- javax.jws.soap.SOAPMessageHandlers

javax.jws.WebService

Description

Target: Class

Specifies that the JWS file implements a Web Service.

Attributes

Table B-1 Attributes of the javax.jws.WebService JWS Annotation

Name	Description	Data Type	Required?
name	Name of the Web Service. Maps to the `<wsdl:portType>` element in the WSDL file. Default value is the unqualified name of the Java class in the JWS file.	String	No.
targetNamespace	The XML namespace used for the WSDL and XML elements generated from this Web Service. The default value is specified by the JAX-RPC specification.	String.	No.
serviceName	Service name of the Web Service. Maps to the `<wsdl:service>` element in the WSDL file. Default value is the unqualified name of the Java class in the JWS file, appended with the string `Service`.	String	No.
wsdlLocation	Relative or absolute URL of a pre-defined WSDL file. If you specify this attribute, the `jwsc` Ant task does not generate a WSDL file, and returns an error if the JWS file is inconsistent with the port types and bindings in the WSDL file. **Note:** The `wsdlc` Ant task uses this attribute when it generates the endpoint interface JWS file from a WSDL. Typically, users never use the attribute in their own JWS files.	String.	No.
endpointInterface	Fully qualified name of an existing service endpoint interface file. If you specify this attribute, it is asumed that you have already created the endpoint interface file and it is in your CLASSPATH.	String.	No.

Example

```
@WebService(name="JMSTransportPortType",
            serviceName="JMSTransportService",
            targetNamespace="http://example.org")
```

javax.jws.WebMethod

Description

Target: Method

Specifies that the method is exposed as a public operation of the Web Service. You must explicitly use this annotation to expose a method; if you do not specify this annotation, the method by default is not exposed.

Attributes

Table B-2 Attributes of the javax.jws.WebMethod JWS Annotation

Name	Description	Data Type	Required?
operationName	Name of the operation. Maps to the `<wsdl:operation>` element in the WSDL file. Default value is the name of the method.	String	No.
action	The action for this operation. For SOAP bindings, the value of this attribute determines the value of the `SOAPAction` header in the SOAP messages.	String	No.

Example

```
@WebMethod(operationName="echoComplexType")

public BasicStruct echoStruct(BasicStruct struct)
{
    ...
}
```

javax.jws.Oneway

Description

Target: Method

Specifies that the method has only input parameters, but does not return a value. This annotation must be used only in conjunction with the `@WebMethod` annotation.

It is an error to use this annotation on a method that returns anything other than `void`, takes a `Holder` class as an input parameter, or throws checked exceptions.

This annotation does not have any attributes.

Example

```
@WebMethod()
@Oneway()
public void helloWorld(String input) {
  ...
}
```

javax.jws.WebParam

Description

Target: Parameter

Customizes the mapping between operation input parameters of the Web Service and elements of the generated WSDL file. Also used to specify the behavior of the parameter.

Attributes

Table B-3 Attributes of the javax.jws.WebParam JWS Annotation

Name	Description	Data Type	Required?
name	Name of the parameter in the WSDL file. For RPC-style Web Services, the name maps to the `<wsdl:part>` element that represents the parameter. For document-style Web Services, the name is the local name of the XML element that represents the parameter. The default value is the name of the method's parameter.	String	No.
targetNamespace	The XML namespace of the parameter. This value is used only used for document-style Web Services, in which the parameter maps to an XML element. The default value is the targetNamespace of the Web Service.	String	No.

Table B-3 Attributes of the javax.jws.WebParam JWS Annotation

Name	Description	Data Type	Required?
mode	The direction in which the parameter is flowing. Valid values are: • `WebParam.Mode.IN` • `WebParam.Mode.OUT` • `WebParam.Mode.INOUT` Default value is `WebParam.Mode.IN`. If you specify `WebParam.Mode.OUT` or `WebParam.Mode.INOUT`, then the data type of the parameter must be `Holder`, or extend `Holder`. For details, see the JAX-RPC specification. `WebParam.Mode.OUT` and `WebParam.Mode.INOUT` modes are only supported for RPC-style Web Services or for parameters that map to headers.	enum	No.
header	Specifies whether the value of the parameter is found in the SOAP header. By default parameters are in the SOAP body. Valid values are `true` and `false`. Default value is `false`.	boolean	No.

Example

```
@WebMethod()
public int echoInt(
    @WebParam(name="IntegerInput",
              targetNamespace="http://example.org/complex")
    int input)
{
  ...
}
```

javax.jws.WebResult

Description

Target: Method

Customizes the mapping between the Web Service operation return value and the corresponding element of the generated WSDL file.

Attributes

Table B-4 Attributes of the javax.jws.WebResult JWS Annotation

Name	Description	Data Type	Required?
name	Name of the parameter in the WSDL file. For RPC-style Web Services, the name maps to the `<wsdl:part>` element that represents the return value. For document-style Web Services, the name is the local name of the XML element that represents the return value. The default value is the hard-coded name `result`.	String	No.
targetNamespace	The XML namespace of the return value. This value is used only used for document-style Web Services, in which the return value maps to an XML element. The default value is the targetNamespace of the Web Service.	String	No.

Example

```
@WebMethod(operationName="echoComplexType")
@WebResult(name="EchoStructReturnMessage",
           targetNamespace="http://example.org/complex")
public BasicStruct echoStruct(BasicStruct struct)
{
  ...
}
```

javax.jws.HandlerChain

Description

Target: Class

Associates a Web Service with an external file that contains the configuration of a handler chain. The configuration includes the list of handlers in the chain, the order in which they execute, the initialization parameters, and so on.

Use the `@HandlerChain` annotation, rather than the `@SOAPMessageHandlers` annotation, in your JWS file if:

- You want multiple Web Services to share the same configuration.
- Your handler chain includes handlers for multiple transports.
- You want to be able to change the handler chain configuration for a Web Service without recompiling the JWS file that implements it.

It is an error to combine this annotation with the `@SOAPMessageHandlers` annotation.

For the XML Schema of 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.

Attributes

Table B-5 Attributes of the javax.jws.HandlerChain JWS Annotation

Name	Description	Data Type	Required?
file	URL, either relative or absolute, of the handler chain configuration file. Relative URLs are relative to the location of JWS file.	String	Yes
name	Name of the handler chain (in the configuration file pointed to by the `file` attribute) that you want to associate with the Web Service.	String	Yes.

Example

```
package examples.webservices.handler;
...
@WebService (...)
@HandlerChain(file="HandlerConfig.xml", name="SimpleChain")
public class HandlerChainImpl {
...
}
```

javax.jws.soap.SOAPBinding

Description

Target: Class

Specifies the mapping of the Web Service onto the SOAP message protocol.

Attributes

Table B-6 Attributes of the javax.jws.soap.SOAPBinding JWS Annotation

Name	Description	Data Type	Required?
style	Specifies the message style of the request and response SOAP messages. Valid values are: • `SOAPBinding.Style.RPC` • `SOAPBinding.Style.DOCUMENT`. Default value is `SOAPBinding.Style.DOCUMENT`.	enum	No.

Table B-6 Attributes of the javax.jws.soap.SOAPBinding JWS Annotation

Name	Description	Data Type	Required?
use	Specifies the formatting style of the request and response SOAP messages. Valid values are: • `SOAPBinding.Use.LITERAL` • `SOAPBinding.Use.ENCODED` Default value is `SOAPBinding.Use.LITERAL`.	enum	No.
parameterStyle	Determines whether method parameters represent the entire message body, or whether the parameters are elements wrapped inside a top-level element named after the operation. Valid values are: • `SOAPBinding.ParameterStyle.BARE` • `SOAPBinding.ParameterStyle.WRAPPED` Default value is `SOAPBinding.ParameterStyle.WRAPPED` **Note:** This attribute applies only to Web Services of style document-literal. Or in other words, you can specify this attribute only if you have also set the `style` attribute to `SOAPBinding.Style.DOCUMENT` and the `use` attribute to `SOAPBinding.Use.LITERAL`.	enum	No.

Example

```
package examples.webservices.bindings;

...

@WebService (...)

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

public class BindingsImpl {

...

}
```

javax.jws.soap.SOAPMessageHandler

Description

Target: None; this annotation can be used only inside of a `@SOAPMessageHandler` array.

Specifies a particular SOAP message handler in a `@SOAPMessageHandler` array. The annotation includes attributes to specify the class name of the handler, the initialization parameters, list of SOAP headers processed by the handler, and so on.

Attributes

Table B-7 Attributes of the javax.jws.soap.SOAPMessageHandler JWS Annotation

Name	Description	Data Type	Required?
name	Name of the SOAP message handler. The default value is the name of the class that implements the `Handler` interface (or extends the `GenericHandler` abstract class.)	String	No.
className	Name of the handler class.	String	Yes.
initParams	Array of name/value pairs that is passed to the handler class during initialization.	Array of `@InitParam`	No.
roles	List of SOAP roles implemented by the handler.	Array of String	No.
headers	List of SOAP headers processed by the handler. Each element in this array contains a QName which defines the header element processed by the handler.	Array of String	No.

Example

```
package examples.webservices.handlers;

...

@WebService (...)
```

```
@SOAPMessageHandlers ( {
  @SOAPMessageHandler (

className="examples.webservices.soap_handlers.simple.ServerHandler1"),
  @SOAPMessageHandler (
   className="examples.webservices.soap_handlers.simple.ServerHandler2")
} )

public class HandlersImpl {

...

}
```

javax.jws.soap.InitParam

Description

Target: None; this annotation can be used only as a value to the `initParams` attribute of the `@SOAPMessageHandler` annotation.

Use this annotation in the `initParams` attribute of the `@SOAPMessageHandler` annotation to specify the array of parameters (name/value pairs) that are passed to a handler class during initialization.

Attributes

Table B-8 Attributes of the javax.jws.soap.InitParam JWS Annotation

Name	Description	Data Type	Required?
name	Name of the initialization parameter.	String	Yes.
value	Value of the initialization parameter.	String	Yes.

javax.jws.soap.SOAPMessageHandlers

Description

Target: Class

Specifies an array of SOAP message handlers that execute before and after the operations of a Web Service. Use the `@SOAPMessageHandler` annotation to specify a particular handler.

Because you specify the list of handlers within the JWS file itself, the configuration of the handler chain is embedded within the Web Service.

Use the `@SOAPMessageHandlers` annotation, rather than `@HandlerChain`, if:

- You prefer to embed the configuration of the handler chain inside the Web Service itself, rather than specify the configuration in an external file.
- Your handler chain includes only SOAP handlers and none for any other transport.
- You prefer to recompile the JWS file each time you change the handler chain configuration.

The `@SOAPMessageHandlers` annotation is an array of `@SOAPMessageHandler` types. The handlers run in the order in which they appear in the annotation, starting with the first handler in the array.

This annotation does not have any attributes.

Example

```
package examples.webservices.handlers;

...

@WebService (...)

@SOAPMessageHandlers ( {
  @SOAPMessageHandler (

className="examples.webservices.soap_handlers.simple.ServerHandler1"),
  @SOAPMessageHandler (
   className="examples.webservices.soap_handlers.simple.ServerHandler2")
} )

public class HandlersImpl {

...

}
```

WebLogic-Specific JWS Annotations Reference

WebLogic Web Services define a set of JWS annotations that you can use to specify behavior and features in addition to the standard JSR-181 JWS annotations. In particular, the WebLogic-specific annotations are:

- “weblogic.jws.AsyncFailure” on page B-16

- "weblogic.jws.AsyncResponse" on page B-19
- "weblogic.jws.BufferQueue" on page B-22
- "weblogic.jws.Context" on page B-24
- "weblogic.jws.Conversation" on page B-25
- "weblogic.jws.Conversational" on page B-27
- "weblogic.jws.MessageBuffer" on page B-30
- "weblogic.jws.Policies" on page B-32
- "weblogic.jws.Policy" on page B-33
- "weblogic.jws.ReliabilityBuffer" on page B-35
- "weblogic.jws.ServiceClient" on page B-37
- "weblogic.jws.Transactional" on page B-40
- "weblogic.jws.WLHttpTransport" on page B-41
- "weblogic.jws.WLHttpsTransport" on page B-43
- "weblogic.jws.WLJmsTransport" on page B-45
- "weblogic.jws.WSDL" on page B-47
- "weblogic.jws.security.SecurityRoles" on page B-48
- "weblogic.jws.security.SecurityIdentity" on page B-50
- "weblogic.jws.security.WssConfiguration" on page B-51

weblogic.jws.AsyncFailure

Description

Target: Method

Specifies the method that handles a potential failure when the main JWS file invokes an operation of another Web Service asynchronously.

When you invoke, from within a JWS file, a Web Service operation asynchronously, the response (or exception, in the case of a failure) does not return immediately after the operation invocation, but rather, at some later point in time. Because the operation invocation did not wait for a response, a separate method in the JWS file must handle the response when it does finally return; similarly, another method must handle a potential failure. Use the `@AsyncFailure` annotation to specify the method in the JWS file that will handle the potential failure of an asynchronous operation invocation.

The `@AsyncFailure` annotation takes two parameters: the name of the JAX-RPC stub for the Web Service you are invoking and the name of the operation that you are invoking asynchronously. The JAX-RPC stub is the one that has been annotation with the `@ServiceClient` annotation.

The method that handles the asynchronous failure must follow these guidelines:

- Return `void`.
- Be named `on`*`MethodName`*`AsyncFailure`, where *`MethodName`* is the name of the method you are invoking asynchronously (with initial letter always capitalized.)

  In the main JWS file, the call to the asynchronous method will look something like:

  ```
  port.getQuoteAsync (apc, symbol);
  ```

  where `getQuote` is the non-asynchronous name of the method, `apc` is the asynchronous pre-call context, and `symbol` is the usual parameter to the `getQuote` operation.
- Have two parameters: the asynchronous post-call context (contained in the `weblogic.wsee.async.AsyncPostCallContext` object) and the `Throwable` exception, potentially thrown by the asynchronous operation call.

Within the method itself you can get more information about the method failure from the context, and query the specific type of exception and act accordingly.

Typically, you always use the `@AsyncFailure` annotation to explicitly specify the method that handles asynchronous operation failures. The only time you would not use this annotation is if you want a single method to handle failures for two or more stubs that invoke different Web Services. In this case, although the stubs connect to different Web Services, each Web Service must have a similarly named method, because the Web Services runtime relies on the name of the method (`on`*`MethodName`*`AsyncFailure`) to determine how to handle the asynchronous failure, rather than the annotation. However, if you always want a one-to-one correspondence between a stub and the method that handles an asynchronous failure from one of the operations, then BEA recommends that you explicitly use `@AsyncFailure`.

See “Invoking a Web Service Using Asynchronous Request-Response” on page 6-17 for detailed information and examples of using this annotation.

Attributes

Table B-9 Attributes of the weblogic.jws.AsyncFailure JWS Annotation Tag

Name	Description	Data Type	Required?
target	The name of the JAX-RPC stub of the Web Service for which you want to invoke an operation asynchronously. The stub is the one that has been annotated with the `@ServiceClient` field-level annotation.	String	Yes
operation	The name of the operation that you want to invoke asynchronously. This is the *actual* name of the operation, as it appears in the WSDL file. When you invoke this operation in the main code of the JWS file, you add `Async` to its name. For example, if set `operation="getQuote"`, then in the JWS file you invoke it asynchronously as follows: `port.getQuoteAsync (apc, symbol);`	String	Yes.

Example

The following sample snippet shows how to use the `@AsyncFailure` annotation in a JWS file that invokes the operation of another Web Service asynchronously; only the relevant Java code is included:

```
package examples.webservices.async_req_res;

...

public class StockQuoteClientImpl {

  @ServiceClient(wsdlLocation="http://localhost:7001/async/StockQuote?WSDL",
                 serviceName="StockQuoteService", portName="StockQuote")
  private StockQuotePortType port;

  @WebMethodpublic void getQuote (String symbol) {

    AsyncPreCallContext apc = AsyncCallContextFactory.getAsyncPreCallContext();
    apc.setProperty("symbol", symbol);

    try {
      port.getQuoteAsync(apc, symbol );
```

```
      System.out.println("in getQuote method of StockQuoteClient WS");
    }
    catch (RemoteException e) {
      e.printStackTrace();
    }

  }

...

  @AsyncFailure(target="port", operation="getQuote")
  public void onGetQuoteAsyncFailure(AsyncPostCallContext apc, Throwable e) {
    System.out.println("-------------------");
    e.printStackTrace();
    System.out.println("-------------------");
  }

}
```

The example shows a JAX-RPC stub called `port`, used to invoke the Web Service located at `http://localhost:7001/async/StockQuote`. The `getQuote` operation is invoked asynchronously, and any exception from this invocation is handled by the `onGetQuoteAsyncFailure` method, as specified by the `@AsyncFailure` annotation.

weblogic.jws.AsyncResponse

Description

Target: Method

Specifies the method that handles the response when the main JWS file invokes an operation of another Web Service asynchronously.

When you invoke, from within a JWS file, a Web Service operation asynchronously, the response does not return immediately after the operation invocation, but rather, at some later point in time. Because the operation invocation did not wait for a response, a separate method in the JWS file must handle the response when it does finally return. Use the `@AsyncResponse` annotation to specify the method in the JWS file that will handle the response of an asynchronous operation invocation.

The `@AsyncResponse` annotation takes two parameters: the name of the JAX-RPC stub for the Web Service you are invoking and the name of the operation that you are invoking asynchronously. The JAX-RPC stub is the one that has been annotation with the `@ServiceClient` annotation.

The method that handles the asynchronous response must follow these guidelines:

- Return `void`.
- Be named `on`*`MethodName`*`AsyncResponse`, where *`MethodName`* is the name of the method you are invoking asynchronously (with initial letter always capitalized.)

  In the main JWS file, the call to the asynchronous method will look something like:

  ```
  port.getQuoteAsync (apc, symbol);
  ```

  where `getQuote` is the non-asynchronous name of the method, `apc` is the asynchronous pre-call context, and `symbol` is the usual parameter to the `getQuote` operation.
- Have two parameters: the asynchronous post-call context (contained in the `weblogic.wsee.async.AsyncPostCallContext` object) and the usual return value of the operation.

Within the asynchronous-response method itself you add the code to handle the response. You can also get more information about the method invocation from the context.

Typically, you always use the `@AsyncResponse` annotation to explicitly specify the method that handles asynchronous operation responses. The only time you would not use this annotation is if you want a single method to handle the response for two or more stubs that invoke different Web Services. In this case, although the stubs connect to different Web Services, each Web Service must have a similarly named method, because the Web Services runtime relies on the name of the method (`on`*`MethodName`*`AsyncResponse`) to determine how to handle the asynchronous response, rather than the annotation. However, if you always want a one-to-one correspondence between a stub and the method that handles an asynchronous response from one of the operations, then BEA recommends that you explicitly use `@AsyncResponse`.

See "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17 for detailed information and examples of using this annotation.

Attributes

Table B-10 Attributes of the weblogic.jws.AsyncResponse JWS Annotation Tag

Name	Description	Data Type	Required?
target	The name of the JAX-RPC stub of the Web Service for which you want to invoke an operation asynchronously. The stub is the one that has been annotated with the `@ServiceClient` field-level annotation.	String	Yes
operation	The name of the operation that you want to invoke asynchronously. This is the *actual* name of the operation, as it appears in the WSDL file. When you invoke this operation in the main code of the JWS file, you add `Async` to its name. For example, if set `operation="getQuote"`, then in the JWS file you invoke it asynchronously as follows: `port.getQuoteAsync (apc, symbol);`	String	Yes.

Example

The following sample snippet shows how to use the `@AsyncResponse` annotation in a JWS file that invokes the operation of another Web Service asynchronously; only the relevant Java code is included:

```
package examples.webservices.async_req_res;

...

public class StockQuoteClientImpl {

  @ServiceClient(wsdlLocation="http://localhost:7001/async/StockQuote?WSDL",
                 serviceName="StockQuoteService", portName="StockQuote")
  private StockQuotePortType port;

  @WebMethodpublic void getQuote (String symbol) {

    AsyncPreCallContext apc = AsyncCallContextFactory.getAsyncPreCallContext();
    apc.setProperty("symbol", symbol);

    try {
      port.getQuoteAsync(apc, symbol );
```

```
      System.out.println("in getQuote method of StockQuoteClient WS");
    }
    catch (RemoteException e) {
      e.printStackTrace();
    }

  }

...

  @AsyncResponse(target="port", operation="getQuote")
  public void onGetQuoteAsyncResponse(AsyncPostCallContext apc, int quote) {
    System.out.println("-------------------");
    System.out.println("Got quote " + quote );
    System.out.println("-------------------");
  }

}
```

The example shows a JAX-RPC stub called `port`, used to invoke the Web Service located at `http://localhost:7001/async/StockQuote`. The `getQuote` operation is invoked asynchronously, and the response from this invocation is handled by the `onGetQuoteAsyncResponse` method, as specified by the `@AsyncResponse` annotation.

weblogic.jws.BufferQueue

Description

Target: Class

Specifies the JNDI name of the JMS queue to which WebLogic Server:

- stores a buffered Web Service operation invocation.
- stores a reliable Web Service operation invocation.

When used with buffered Web Services, you use this annotation in conjunction with `@MessageBuffer`, which specifies the methods of a JWS that are buffered. When used with reliable Web Services, you use this annotation in conjunction with `@Policy`, which specifies the reliable messaging WS-Policy file associated with the Web Service.

If you have enabled buffering or reliable messaging for a Web Service, but do not specify the `@BuffereQueue` annotation, WebLogic Server uses the default Web Services JMS queue (`weblogic.wsee.DefaultQueue`) to store buffered or reliable operation invocations. This JMS queue is also the default queue for the JMS transport features. It is assumed that you have already created this JMS queue if you intend on using it for any of these features.

See “Creating Buffered Web Services” on page 6-37 and “Using Web Service Reliable Messaging” on page 6-1 for detailed information and examples of creating buffered or reliable Web Services.

Attributes

Table B-11 Attributes of the weblogic.jws.BufferQueue JWS Annotation Tag

Name	Description	Data Type	Required?
name	The JNDI name of the JMS queue to which the buffered or reliable operation invocation is queued.	String	Yes

Example

The following example shows a code snippet from a JWS file in which the public operation is buffered and the JMS queue to which WebLogic Server queues the operation invocation is called `my.buffere.queue`; only the relevant Java code is shown:

```
package examples.webservices.buffered;

...

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

@BufferQueue(name="my.buffer.queue")

public class BufferedImpl {

...

  @WebMethod()
  @MessageBuffer(retryCount=10, retryDelay="10 seconds")
  @Oneway()
  public void sayHelloNoReturn(String message) {
    System.out.println("sayHelloNoReturn: " + message);
  }
}
```

weblogic.jws.Context

Description

Target: Field

Specifies that the annotated field provide access to the runtime context of the 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 can use to access, and sometimes change, runtime information about the service. Much of this information is related to conversations, such as whether the current conversation is finished, the current values of the conversational properties, changing conversational properties at runtime, and so on. Some of the information accessible via the context is more generic, such as the protocol that was used to invoke the Web Service (HTTP/S or JMS), the SOAP headers that were in the SOAP message request, and so on. The data type of the annotation field must be `weblogic.wsee.jws.JwsContext`, which is a WebLogic Web Service API that includes methods to query the context.

For additional information about using this annotation, see "Accessing Runtime Information about a Web Service Using the JwsContext" on page 5-10.

This annotation does not have any attributes.

Example

The following snippet of a JWS file shows how to use the `@Context` annotation; only parts of the file are shown, with relevant code in bold:

```
...
import weblogic.jws.Context;
import weblogic.wsee.jws.JwsContext;

...
public class JwsContextImpl {

  @Context
  private JwsContext ctx;

  @WebMethod()
  public String getProtocol() {

...
```

weblogic.jws.Conversation

Description

Target: Method

Specifies that a method annotated with the `@Conversation` annotation can be invoked as part of a conversation between two WebLogic Web Services or a stand-alone Java client and a conversational Web Service.

The conversational Web Service typically specifies three methods, each annotated with the `@Conversation` annotation that correspond to the start, continue, and finish phases of a conversation. Use the `@Conversational` annotation to specify, at the class level, that a Web Service is conversational and to configure properties of the conversation, such as the maximum idle time.

If the conversation is between two Web Services, the client service uses the `@ServiceClient` annotation to specify the wsdl, service name, and port of the invoked conversational service. In both the service and stand-alone client cases, the client then invokes the start, continue, and finish methods in the appropriate order to conduct a conversation.The only additional requirement to make a Web Service conversational is that it implement `java.io.Serializable`.

See "Creating Conversational Web Services" on page 6-25 for detailed information and examples of using this annotation.

Attributes

Table B-12 Attributes of the weblogic.jws.Conversation JWS Annotation Tag

Name	Description	Data Type	Required?
value	Specifies the phase of a conversation that the annotated method implements. Possible values are: • `Phase.START` Specifies that the method starts a new conversation. A call to this method creates a new conversation ID and context, and resets its idle and age timer. • `Phase.CONTINUE` Specifies that the method is part of a conversation in progress. A call to this method resets the idle timer. This method must always be called after the start method and before the finish method. • `Phase.FINISH` Specifies that the method explicitly finishes a conversation in progress. Default value is `Phase.CONTINUE`	enum	No.

Example

The following sample snippet shows a JWS file that contains three methods, `start`, `middle`, and `finish`) that are annotated with the `@Conversation` annotation to specify the start, continue, and finish phases, respectively, of a conversation.

```
...
public class ConversationalServiceImpl implements Serializable {

  @WebMethod
  @Conversation (Conversation.Phase.START)
  public String start() {
    // Java code for starting a conversation goes here
  }

  @WebMethod
  @Conversation (Conversation.Phase.CONTINUE)
  public String middle(String message) {
```

```
    // Java code for continuing a conversation goes here
  }

  @WebMethod
  @Conversation (Conversation.Phase.FINISH)
  public String finish(String message ) {
    // Java code for finishing a conversation goes here
  }

}
```

weblogic.jws.Conversational

Description

Target: Class

Specifies that a JWS file implements a conversational Web Service.

You are not required to use this annotation to specify that a Web Service is conversational; by simply annotating a single method with the `@Conversation` annotation, all the methods of the JWS file are automatically tagged as conversational. Use the class-level `@Conversational` annotation only if you want to change some of the conversational behavior or if you want to clearly show at the class level that the JWS if conversational.

If you do use the `@Conversational` annotation in your JWS file, you can specify it without any attributes if their default values suit your needs. However, if you want to change values such as the maximum amount of time that a conversation can remain idle, the maximum age of a conversation, and so on, specify the appropriate attribute.

See "Creating Conversational Web Services" on page 6-25 for detailed information and examples of using this annotation.

Attributes

Table B-13 Attributes of the weblogic.jws.Conversational JWS Annotation Tag

Name	Description	Data Type	Required?
maxIdleTime	Specifies the amount of time that a conversation can remain idle before it is finished by WebLogic Server. Activity is defined by a client Web Service executing one of the phases of the conversation. Valid values are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a maximum idle time of ten minutes, specify the annotation as follows: `@Conversational(maxIdleTime="10 minutes")` If you specify a zero-length value (such as `0 seconds`, or `0 minutes` and so on), then the conversation never times out due to inactivity. Default value is `0 seconds`.	String	No.
maxAge	The amount of time that a conversation can remain active before it is finished by WebLogic Server. Valid values are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a maximum age of three days, specify the annotation as follows: `@Conversational(maxAge="3 days")` Default value is `1 day`.	String	No

Table B-13 Attributes of the weblogic.jws.Conversational JWS Annotation Tag

Name	Description	Data Type	Required?
runAsStartUser	Specifies whether the continue and finish phases of an existing conversation are run as the user who started the conversation. Typically, the same user executes the start, continue, and finish methods of a conversation, so that changing the value of this attribute has no effect. However, if you set the `singlePrincipal` attribute to false, which allows users different from the user who initiated the conversation to execute the continue and finish phases of an existing conversation, then the `runAsStartUser` attribute specifies which user the methods are actually "run as": the user who initiated the conversation or the different user who executes subsequent phases of the conversation. Valid values are `true` and `false`. Default value is `true`, which means that the continue and finish phases are always run as the user who started the conversation.	boolean	No.
singlePrincipal	Specifies whether users other than the one who started a conversation are allowed to execute the continue and finish phases of the conversation. Typically, the same user executes all phases of a conversation. However, if you set this attribute to `false`, then other users can obtain the conversation ID of an existing conversation and use it to execute later phases of the conversation. Valid values are `true` and `false`. Default value is `true`, which means only the user who started the conversation can continue and finish it.	boolean	No

Example

The following sample snippet shows how to specify that a JWS file implements a conversational Web Service. The maximum amount of time the conversation can be idle is ten minutes, and the maximum age of the conversation, regardless of activity, is one day. The continue and finish phases of the conversation can be executed by a user other than the one that started the conversation; if this happens, then the corresponding methods are run as the new user, not the original user.

```
package examples.webservices.conversation;

...
```

```
@Conversational(maxIdleTime="10 minutes",
                maxAge="1 day",
                runAsStartUser=false,
                singlePrincipal=false )
public class ConversationalServiceImpl implements Serializable {
...
```

weblogic.jws.MessageBuffer

Description

Target: Method

Specifies which public methods of a JWS are buffered.

When a client Web Service invokes a buffered operation of a different WebLogic Web Service, WebLogic Server (hosting the invoked Web Service) puts the invoke message on a JMS queue and the actual invoke is dealt with later on when the WebLogic Server delivers the message from the top of the JMS queue to the Web Service implementation. The client does not need to wait for a response, but rather, continues on with its execution. For this reason, buffered operations (without any additional asynchronous features) can only return `void` and must be marked with the `@Oneway` annotation. If you want to buffer an operation that returns a value, you must use asynchronous request-response from the invoking client Web Service. See "Invoking a Web Service Using Asynchronous Request-Response" on page 6-17 for more information.

Buffering works only between two Web Services in which one invokes the buffered operations of the other.

Use the optional attributes of `@MessageBuffer` to specify the number of times the JMS queue attempts to invoke the buffered Web Service operation until it is invoked successfully, and the amount of time between attempts.

Use the optional class-level `@BufferQueue` annotation to specify the JMS queue to which the invoke messages are queued. If you do not specify this annotation, the messages are queued to the default Web Service queue, `weblogic.wsee.DefaultQueue`.

See "Creating Buffered Web Services" on page 6-37 for detailed information and examples for using this annotation.

Attributes

Table B-14 Attributes of the weblogic.jws.MessageBuffer JWS Annotation Tag

Name	Description	Data Type	Required?
retryCount	Specifies the number of times that the JMS queue on the invoked WebLogic Server instance attempts to deliver the invoking message to the Web Service implementation until the operation is successfully invoked. Default value is 3.	int	No
retryDelay	Specifies the amount of time that elapses between message delivery retry attempts. The retry attempts are between the invoke message on the JMS queue and delivery of the message to the Web Service implementation. Valid values are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a retry delay of two days, specify: `@MessageBuffer(retryDelay="2 days")` Default value is `5 seconds`.	String	No

Example

The following example shows a code snippet from a JWS file in which the public operation `sayHelloNoReturn` is buffered and the JMS queue to which WebLogic Server queues the operation invocation is called `my.buffere.queue`. The WebLogic Server instance that hosts the invoked Web Service tries a maximum of 10 times to deliver the invoke message from the JMS queue to the Web Service implementation, waiting 10 seconds between each retry. Only the relevant Java code is shown in the following snippet:

```
package examples.webservices.buffered;

...
```

```
@WebService(name="BufferedPortType",
            serviceName="BufferedService",
            targetNamespace="http://example.org")

@BufferQueue(name="my.buffer.queue")

public class BufferedImpl {

...

  @WebMethod()
  @MessageBuffer(retryCount=10, retryDelay="10 seconds")
  @Oneway()
  public void sayHelloNoReturn(String message) {
    System.out.println("sayHelloNoReturn: " + message);
  }
}
```

weblogic.jws.Policies

Description

Target: Class, Method

Specifies an array of `@weblogic.jws.Policy` annotations.

Use this annotation if you want to attach more than one WS-Policy files to a class or method of a JWS file. If you want to attach just one policy file, you can use the `@weblogic.jws.Policy` on its own.

See "Using Web Service Reliable Messaging" on page 6-1 and "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2 for detailed information and examples of using this annotation.

This JWS annotation does not have any attributes.

Example

```
@Policies({
    @Policy(uri="policy:firstPolicy.xml"),
    @Policy(uri="policy:secondPolicy.xml")
  })
```

weblogic.jws.Policy

Description

Target: Class, Method

Specifies that a WS-Policy file, which contains information about digital signatures, encryption, or Web Service reliable messaging, should be applied to the request or response SOAP messages.

This annotation can be used on its own to apply a single WS-Policy file to a class or method. If you want to apply more than one WS-Policy file to a class or method, use the `@weblogic.jws.Policies` annotation to group them together.

If this annotation is specified at the class level, the indicated policy file or files are applied to every public operation of the Web Service. If the annotation is specified at the method level, then only the corresponding operation will have the policy file applied.

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 default, the specified WS-Policy file is attached to the generated and published WSDL file of the Web Service so that consumers can view all the policy requirements of the Web Service. Use the `attachToWsdl` attribute to change this default behavior.

See "Using Web Service Reliable Messaging" on page 6-1 and "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2 for detailed information and examples of using this annotation.

Attributes

Table B-15 Attributes of the weblogic.jws.Policies JWS Annotation Tag

Name	Description	Data Type	Required?
uri	Specifies the location from which to retrieve the WS-Policy file. Use the `http:` prefix to specify the URL of a policy file on the Web. Use the `policy`: prefix to specify that the policy file is packaged in the Web Service archive file or in a shareable J2EE library of WebLogic Server, as shown in the following example: `@Policy(uri="policy:MyPolicyFile.xml")` If you are going to publish the policy file in the Web Service archive, the policy XML file must be located in either the `META-INF/policies` or `WEB-INF/policies` directory of the EJB JAR file (for EJB implemented Web Services) or WAR file (for Java class implemented Web Services), respectively. For information on publishing the policy file in a library, see Creating Shared J2EE Libraries and Optional Packages.	String	Yes.
direction	Specifies when to apply the policy: on the inbound request SOAP message, the outbound response SOAP message, or both (default). Valid values for this attribute are: • `Policy.Direction.both` • `Policy.Direction.inbound` • `Policy.Direction.outbound` The default value is `Policy.Direction.both`.	enum	No.
attachToWsdl	Specifies whether the WS-Policy file should be attached to the WSDL that describes the Web Service. Valid values are `true` and `false`. Default value is `false`.	boolean	No.

Example

```
@Policy(uri="policy:myPolicy.xml",
        attachToWsdl=true,
        direction=Policy.Direction.outbound)
```

weblogic.jws.ReliabilityBuffer

Description

Target: Method

Use this annotation to configure reliable messaging properties for an operation of a reliable Web Service, such as the number of times WebLogic Server should attempt to deliver the message from the JMS queue to the Web Service implementation, and the amount of time that the server should wait in between retries.

Note: It is assumed when you specify this annotation in a JWS file that you have already enabled reliable messaging for the Web Service by also including a `@Policy` annotation that specifies a WS-Policy file that has Web Service reliable messaging policy assertions.

If you specify the `@ReliabilityBuffer` annotation, but do not enable reliable messaging with an associated WS-Policy file, then WebLogic Server ignores this annotation.

See "Using Web Service Reliable Messaging" on page 6-1 for detailed information about enabling Web Services reliable messaging for your Web Service.

Attributes

Table B-16 Attributes of the weblogic.jws.ReliabilityBuffer JWS Annotation Tag

Name	Description	Data Type	Required?
retryCount	Specifies the number of times that the JMS queue on the destination WebLogic Server instance attempts to deliver the message from a client that invokes the reliable operation to the Web Service implementation. Default value is 3.	int	No
retryDelay	Specifies the amount of time that elapses between message delivery retry attempts. The retry attempts are between the client's request message on the JMS queue and delivery of the message to the Web Service implementation. Valid values are a number and one of the following terms: • `seconds` • `minutes` • `hours` • `days` • `years` For example, to specify a retry delay of two days, specify: `@ReliabilityBuffer(retryDelay="2 days")` Default value is `5 seconds.`	String	No

Example

The following sample snippet shows how to use the `@ReliabilityBuffer` annotation at the method-level to change the default retry count and delay of a reliable operation; only relevant Java code is shown:

```
package examples.webservices.reliable;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.Oneway;
```

```
...
import weblogic.jws.ReliabilityBuffer;
import weblogic.jws.Policy;

@WebService(name="ReliableHelloWorldPortType",
              serviceName="ReliableHelloWorldService")

...

@Policy(uri="ReliableHelloWorldPolicy.xml",
          direction=Policy.Direction.inbound,
          attachToWsdl=true)

public class ReliableHelloWorldImpl {

  @WebMethod()
  @Oneway()
  @ReliabilityBuffer(retryCount=10, retryDelay="10 seconds")

  public void helloWorld(String input) {
    System.out.println(" Hello World " + input);

  }
}
```

weblogic.jws.ServiceClient

Description

Target: Field

Specifies that the annotated variable in the JWS file is a JAX-RPC stub used to invoke another WebLogic Web Service when using the following features:

- Web Service reliable messaging
- asynchronous request-response
- conversations

You use the reliable messaging and asynchronous request-response features only between two Web Services; this means, for example, that you can invoke a reliable Web Service operation only from within another Web Service, not from a stand-alone client. In the case of reliable messaging, the feature works between *any* two application servers that implement the WS-ReliableMessaging 1.0 specification In the case of asynchronous request-response, the feature works only between two WebLogic Server instances.

You use the `@ServiceClient` annotation in the client Web Service to specify which variable is a JAX-RPC port type for the Web Service described by the `@ServiceClient` attributes. The Enterprise Application that contains the client Web Service must also include the JAX-RPC stubs of the Web Service you are invoking; you generate the stubs with the `clientgen` Ant task.

See Chapter 6, “Advanced JWS Programming: Implementing Asynchronous Features,” for additional information and examples of using the `@ServiceClient` annotation.

Attributes

Table B-17 Attributes of the weblogic.jws.ServiceClient JWS Annotation Tag

Name	Description	Data Type	Required?
serviceName	Specifies the name of the Web Service that you are invoking. Corresponds to the `name` attribute of the `<service>` element in the WSDL of the invoked Web Service. If you used a JWS file to implement the invoked Web Service, this attribute corresponds to the `serviceName` attribute of the `@WebService` JWS annotation in the invoked Web Service.	String	Yes
portName	Specifies the name of the port of the Web Service you are invoking. Corresponds to the `name` attribute of the `<port>` child element of the `<service>` element. If you used a JWS file to implement the invoked Web Service, this attribute corresponds to the `portName` attribute of the `@WLHttpTransport` JWS annotation in the invoked Web Service. If you do not specify this attribute, it is assumed that the `<service>` element in the WSDL contains only one `<port>` child element, which `@ServiceClient` uses. If there is more than one port, the client Web Service returns a runtime exception.	String	No.

Table B-17 Attributes of the weblogic.jws.ServiceClient JWS Annotation Tag

Name	Description	Data Type	Required?
wsdlLocation	Specifies the WSDL file that describes the Web Service you are invoking. If you do not specify this attribute, the client Web Service uses the WSDL file from which the `clientgen` Ant task created the JAX-RPC `Service` implementation of the Web Service to be invoked.	String	No.
endpointAddress	Specifies the endpoint address of the Web Service you are invoking. If you do not specify this attribute, the client Web Service uses the endpoint address specified in the WSDL file.	String	No.

Example

The following JWS file excerpt shows how to use the `@ServiceClient` annotation in a client Web Service to annotate a field (`port`) with the JAX-RPC stubs of the Web Service being invoked (called `ReliableHelloWorldService` whose WSDL is at the URL `http://localhost:7001/ReliableHelloWorld/ReliableHelloWorld?WSDL`); only relevant parts of the example are shown:

```
package examples.webservices.reliable;

import javax.jws.WebService;

...

import weblogic.jws.ServiceClient;

import examples.webservices.reliable.ReliableHelloWorldPortType;

@WebService(...

public class ReliableClientImpl

{

  @ServiceClient(

wsdlLocation="http://localhost:7001/ReliableHelloWorld/ReliableHelloWor
ld?WSDL",
     serviceName="ReliableHelloWorldService",
     portName="ReliableHelloWorldServicePort")

  private ReliableHelloWorldPortType port;
```

```
@WebMethod
public void callHelloWorld(String input, String serviceUrl)
   throws RemoteException {
  port.helloWorld(input);
  System.out.println(" Invoked the ReliableHelloWorld.helloWorld
operation reliably." );
 }
}
```

weblogic.jws.Transactional

Description

Target: Class, Method

Specifies whether the annotated operation, or all the operations of the JWS file when the annotation is specified at the class-level, runs or run inside of a transaction. By default, the operations do *not* run inside of a transaction.

Note: The `@Transactional` annotation only makes sense within the context of an EJB-implemented Web Service. For this reason, you can specify this annotation only inside of a JWS file that explicitly implements `javax.ejb.SessionBean`. See Transaction Design and Management Options in the Programming WebLogic Enterprise JavaBeans guide for additional information about stateless session EJBs that run inside of a transaction. See "Should You Implement a Stateless Session EJB?" on page 5-16 for information about explicitly implementing an EJB in a JWS file.

Attributes

Table B-18 Attributes of the weblogic.jws.Transactional JWS Annotation Tag

Name	Description	Data Type	Required?
value	Specifies whether the operation (when used at the method level) or all the operations of the Web Service (when specified at the class level) run inside of a transaction. Valid values are `true` and `false`. Default value is `false`.	boolean	No.

Example

The following sample snippet shows how to use the `@Transactional` annotation to specify that an operation of a Web Service executes as part of a transaction; only relevant parts of the JWS file are shown:

```
package examples.webservices.transactional;

import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

import javax.jws.WebService;

import weblogic.jws.Transactional;

import weblogic.ejbgen.Session;

@Session(
  ejbName="TransactionEJB",
  serviceEndpoint="examples.webservices.transactional.TransactionImplPortType")

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

...

public class TransactionImpl implements SessionBean {

  @Transactional(value=true)

  public String sayHello(String message) {
    System.out.println("sayHello:" + message);
    return "Here is the message: '" + message + "'";
  }

  // Standard EJB methods.  Typically there's no need to override the methods.

  public void ejbCreate() {}
  ...

}
```

weblogic.jws.WLHttpTransport

Description

Target: Class

Specifies the context path and service URI sections of the URL used to invoke the Web Service over the HTTP transport, as well as the name of the port in the generated WSDL.

You can specify this annotation only once in a JWS file. Additionally, if you specify this annotation, you cannot specify any of the other transport annotations (`@WLHttpsTransport` or `@WLJmsTransport`).

Attributes

Table B-19 Attributes of the weblogic.jws.WLHttpTransport JWS Annotation Tag

Name	Description	Data Type	Required?
contextPath	Context path of the Web Service. You use this value in the URL that invokes the Web Service. For example, assume you set the context path for a Web Service to `financial`; a possible URL for the WSDL of the deployed WebLogic Web Service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its contextPath is `HelloWorldImpl`.	String	No.

Table B-19 Attributes of the weblogic.jws.WLHttpTransport JWS Annotation Tag

Name	Description	Data Type	Required?
serviceUri	Web Service URI portion of the URL. You use this value in the URL that invokes the Web Service. For example, assume you set this attribute to `GetQuote`; a possible URL for the deployed WSDL of the service is as follows: `http://hostname:7001/financial/GetQuote?WSDL` The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its serviceUri is `HelloWorldImpl`.	String	No.
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. The default value of this attribute is based on the `@javax.jws.WebService` annotation of the JWS file. In particular, the default `portName` is the value of the `name` attribute of `@WebService` annotation, plus the actual text `SoapPort`. For example, if `@WebService.name` is set to `MyService`, then the default portName is `MyServiceSoapPort`.	String	No.

Example

```
@WLHttpTransport(contextPath="complex",
                 serviceUri="ComplexService",
                 portName="ComplexServicePort")
```

weblogic.jws.WLHttpsTransport

Description

Target: Class

Specifies the context path and service URI sections of the URL used to invoke the Web Service over the HTTPS transport, as well as the name of the port in the generated WSDL.

You can specify this annotation only once in a JWS file. Additionally, if you specify this annotation, you cannot specify any of the other transport annotations (`@WLHttpTransport` or `@WLJmsTransport`).

Attributes

Table B-20 Attributes of the weblogic.jws.WLHttpsTransport JWS Annotation Tag

Name	Description	Data Type	Required?
contextPath	Context path of the Web Service. You use this value in the URL that invokes the Web Service. For example, assume you set the context path for a Web Service to `financial`; a possible URL for the WSDL of the deployed WebLogic Web Service is as follows: `https://hostname:7001/financial/GetQuote?WSDL` The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its contextPath is `HelloWorldImpl`.	String	No.

Table B-20 Attributes of the weblogic.jws.WLHttpsTransport JWS Annotation Tag

Name	Description	Data Type	Required?
serviceUri	Web Service URI portion of the URL. You use this value in the URL that invokes the Web Service. For example, assume you set this attribute to `GetQuote`; a possible URL for the deployed WSDL of the service is as follows: `https://hostname:7001/financial/GetQuote?WSDL` The default value of this attribute is the name of the JWS file, without its extension. For example, if the name of the JWS file is `HelloWorldImpl.java`, then the default value of its serviceUri is `HelloWorldImpl`.	String	No.
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. The default value of this attribute is based on the `@javax.jws.WebService` annotation of the JWS file. In particular, the default `portName` is the value of the `name` attribute of `@WebService` annotation, plus the actual text `SoapPort`. For example, if `@WebService.name` is set to `MyService`, then the default portName is `MyServiceSoapPort`.	String	No.

Example

```
@WLHttpsTransport(portName="helloSecurePort",
                  contextPath="secure",
                  serviceUri="SimpleSecureBean")
```

weblogic.jws.WLJmsTransport

Description

Target: Class

Specifies the context path and service URI sections of the URL used to invoke the Web Service over the JMS transport, as well as the name of the port in the generated WSDL. You also use this annotation to specify the JMS queue to which WebLogic Server queues the SOAP request messages from invokes of the operations.

You can specify this annotation only once in a JWS file. Additionally, if you specify this annotation, you cannot specify any of the other transport annotations (`@WLHttpTransport` or `@WLHttpsTransport`).

Attributes

Table B-21 Attributes of the weblogic.jws.WLJmsTransport JWS Annotation Tag

Name	Description	Data Type	Required?
contextPath	Context root of the Web Service. You use this value in the URL that invokes the Web Service.	String	No.
serviceUri	Web Service URI portion of the URL used by client applications to invoke the Web Service.	String	No.
queue	The JNDI name of the JMS queue that you have configured for the JMS transport. See "Using JMS Transport as the Connection Protocol" on page 7-1 for details about using JMS transport. The default value of this attribute, if you do not specify it, is `weblogic.wsee.DefaultQueue`. You must still create this JMS queue in the WebLogic Server instance to which you deploy your Web Service.	String	No.
portName	The name of the port in the generated WSDL. This attribute maps to the `name` attribute of the `<port>` element in the WSDL. If you do not specify this attribute, the `jwsc` generates a default name based on the name of the class that implements the Web Service.	String	No.

Example

The following example shows how to specify that the JWS file implements a Web Service that is invoked using the JMS transport. The JMS queue to which WebLogic Server queues SOAP message requests from invokes of the service operations is `JMSTransportQueue`; it is assumed that this JMS queue has already been configured for WebLogic Server.

```
WLJmsTransport(contextPath="transports",
               serviceUri="JMSTransport",
               queue="JMSTransportQueue",
               portName="JMSTransportServicePort")
```

weblogic.jws.WSDL

Description

Target: Class

Specifies whether to expose the WSDL of a deployed WebLogic Web Service.

By default, the WSDL is exposed at the following URL:

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

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`).
- *`contextPath`* and *`serviceUri`* refer to the value of the `contextPath` and `serviceUri` attributes, respectively, of the `@WLHttpTransport` JWS annotation of the JWS file that implements your Web Service.

For example, assume you used the following `@WLHttpTransport` annotation:

```
@WLHttpTransport(portName="helloPort",
                 contextPath="hello",
                 serviceUri="SimpleImpl")
```

The URL to get view the WSDL of the Web Service, assuming the service is running on a host called `ariel` at the default port number, is:

```
http://ariel:7001/hello/SimpleImpl?WSDL
```

Attributes

Table B-22 Attributes of the weblogic.jws.WSDL JWS Annotation Tag

Name	Description	Data Type	Required?
exposed	Specifies whether to expose the WSDL of a deployed Web Service. Valid values are `true` and `false`. Default value is `true`, which means that by default the WSDL *is* exposed.	boolean	No.

Example

The following use of the `@WSDL` annotation shows how to specify that the WSDL of a deployed Web Service not be exposed; only relevant Java code is shown:

```
package examples.webservices;

import....

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

@WSDL(exposed=false)

public class WsdlAnnotationImpl {

...

}
```

weblogic.jws.security.SecurityRoles

Description

Target: Class, Method

Note: The `@weblogic.security.jws.SecurityRoles` JWS annotation is deprecated in this release.

Specifies the roles that are allowed to access the operations of the Web Service.

If you specify this annotation at the class level, then the specified roles apply to all public operations of the Web Service. You can also specify a list of roles at the method level if you want to associate different roles to different operations of the same Web Service.

Note: The `@SecurityRoles` annotation is supported only within the context of an EJB-implemented Web Service. For this reason, you can specify this annotation only inside of a JWS file that explicitly implements `javax.ejb.SessionBean`. See Securing Enterprise JavaBeans (EJBs) for conceptual information about what it means to secure access to an EJB. See "Should You Implement a Stateless Session EJB?" on page 5-16 for information about explicitly implementing an EJB in a JWS file.

Attributes

Table B-23 Attributes of the weblogic.jws.security.SecurityRoles JWS Annotation

Name	Description	Data Type	Required?
rolesAllowed	Specifies the list of roles that are allowed to access the Web Service. This annotation is the equivalent of the `<method-permission>` element in the `ejb-jar.xml` deployment descriptor of the stateless session EJB that implements the Web Service.	Array of String	No.
rolesReferenced	Specifies a list of roles referenced by the Web Service. The Web Service may access other resources using the credentials of the listed roles. This annotation is the equivalent of the `<security-role-ref>` element in the `ejb-jar.xml` deployment descriptor of the stateless session EJB that implements the Web Service.	Array of String	No.

Example

The following example shows how to specify, at the class-level, that the Web Service can be invoked only by the `Admin` role; only relevant parts of the example are shown:

```
package examples.webservices.security_roles;

import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

import weblogic.ejbgen.Session;

import javax.jws.WebService;

...
```

```
import weblogic.jws.security.SecurityRoles;
@Session(ejbName="SecurityRolesEJB")
@WebService(...
// Specifies the roles who can invoke the entire Web Service
@SecurityRoles(rolesAllowed="Admnin")
public class SecurityRolesImpl implements SessionBean {
...
```

weblogic.jws.security.SecurityIdentity

Description

Target: Class

Note: The `@weblogic.security.jws.SecurityIdentity` JWS annotation is deprecated in this release.

Specifies the identity assumed by the Web Service when it is invoked.

Unless otherwise specified, a Web Service assumes the identity of the authenticated invoker. This annotation allows the developer to override this behavior so that the Web Service instead executes as a particular role. The role must map to a user or group in the WebLogic Server security realm.

Note: The `@SecurityIdentity` annotation only makes sense within the context of an EJB-implemented Web Service. For this reason, you can specify this annotation only inside of a JWS file that explicitly implements `javax.ejb.SessionBean`. See Securing Enterprise JavaBeans (EJBs) for conceptual information about what it means to secure access to an EJB. See "Should You Implement a Stateless Session EJB?" on page 5-16 for information about explicitly implementing an EJB in a JWS file.

Attributes

Table B-24 Attributes of the weblogic.jws.security.SecurityIdentity JWS Annotation

Name	Description	Data Type	Required?
value	Specifies the role which the Web Service assumes when it is invoked. The role must map to a user or group in the WebLogic Server security realm.	String	Yes.

Example

The following example shows how to specify that the Web Service, when invoked, runs as the `Admin` role:

```
package examples.webservices.security_roles;

import javax.ejb.SessionBean;
import javax.ejb.SessionContext;

import weblogic.ejbgen.Session;

import javax.jws.WebService;

...

import weblogic.jws.security.SecurityIdentity;

@Session(ejbName="SecurityRolesEJB")

@WebService(...

// Specifies that the Web Service runs as the Admin role

@SecurityIdentity( value="Admin")

public class SecurityRolesImpl implements SessionBean {

...
```

weblogic.jws.security.WssConfiguration

Description

Target: Class

Specifies the name of the Web Service security configuration you want the Web Service to use. If you do not specify this annotation in your JWS file, the Web Service is associated with the default security configuration (called `default_wss`) if it exists in your domain.

The `@WssConfiguration` annotation only makes sense if your Web Service is configured for message-level security (encryption and digital signatures). The security configuration, associated to the Web Service using this annotation, specifies information such as whether to use an X.509 certificate for identity, whether to use password digests, the keystore to be used for encryption and digital signatures, and so on.

WebLogic Web Services are not required to be associated with a security configuration; if the default behavior of the Web Services security runtime is adequate then no additional configuration is needed. If, however, a Web Service requires different behavior from the default (such as using an X.509 certificate for identity, rather than the default username/password token), then the Web Service must be associated with a security configuration.

Before you can successfully invoke a Web Service that specifies a security configuration, you must use the Administration Console to create it. For details, see Create a Web Services security configuration. For general information about message-level security, see "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2.

Attributes

Table B-25 Attributes of the weblogic.jws.security.WssConfiguration JWS Annotation Tag

Name	Description	Data Type	Required?
value	Specifies the name of the Web Service security configuration that is associated with this Web Service. The default configuration is called `default_wss`. You must create the security configuration (even the default one) using the Administration Console before you can successfully invoke the Web Service.	String	Yes.

Example

The following example shows how to specify that a Web Service is associated with the `my_security_configuration` security configuration; only the relevant Java code is shown:

```
package examples.webservices.wss_configuration;

import javax.jws.WebService;
...

import weblogic.jws.security.WssConfiguration;

@WebService(...
...

@WssConfiguration(value="my_security_configuration")

public class WssConfigurationImpl {

...
```

Web Service Reliable Messaging Policy Assertion Reference

The following sections provide reference information about Web Service reliable messaging policy assertions in a WS-Policy file:

- "Overview of a WS-Policy File That Contains Web Service Reliable Messaging Assertions" on page C-1
- "Graphical Representation" on page C-2
- "Example of a WS-Policy File With Web Service Reliable Messaging Assertions" on page C-2
- "Element Description" on page C-3

Overview of a WS-Policy File That Contains Web Service Reliable Messaging Assertions

You use WS-Policy files to configure the reliable messaging capabilities of a WebLogic Web Service running on a destination endpoint. Use the `@Policy` JWS annotations in the JWS file that implements the Web Service to specify the name of the WS-Policy file that is associated with a Web Service.

A WS-Policy file is an XML file that conforms to the WS-Policy specification. The root element of a WS-Policy file is always `<wsp:Policy>`. To configure Web Service reliable messaging, you first add a `<wsrm:RMAssertion>` child element; its main purpose is to group all the reliable messaging policy assertions together. Then you add as child elements to `<wsrm:RMAssertion>`

the assertions that enable the type of Web Service reliable messaging you want. All these assertions conform to the WS-PolicyAssertions specification.

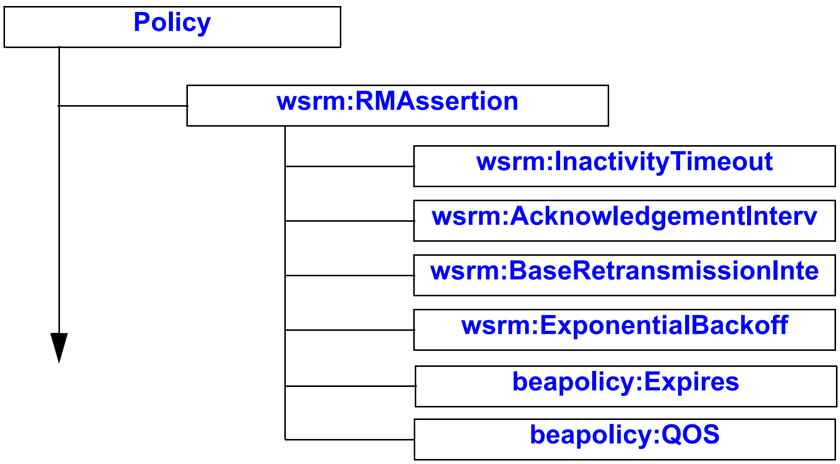
WebLogic Server includes two WS-Policy files (`DefaultReliability.xml` and `LongRunningReliability.xml`) that contain typical reliable messaging assertions that you can use if you do not want to create your own WS-Policy file. For details about these two files, see "Use of WS-Policy Files for Web Service Reliable Messaging Configuration" on page 6-2.

See "Using Web Service Reliable Messaging" on page 6-1 for task-oriented information about creating a reliable WebLogic Web Service.

Graphical Representation

The following graphic describes the element hierarchy of Web Service reliable messaging policy assertions in a WS-Policy file.

Figure 13-1 Element Hierarchy of Web Service Reliable Messaging Policy Assertions



Example of a WS-Policy File With Web Service Reliable Messaging Assertions

The following example shows a simple WS-Policy file used to configure reliable messaging for a WebLogic Web Service:

```
<?xml version="1.0"?>
```

```
<wsp:Policy wsp:Name="ReliableHelloWorldPolicy"
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
   xmlns:wsrm="http://schemas.xmlsoap.org/ws/2005/02/rm">

 <wsrm:RMAssertion>

   <wsrm:InactivityTimeout
      Milliseconds="600000" />
   <wsrm:AcknowledgementInterval
      Milliseconds="2000" />
   <wsrm:BaseRetransmissionInterval
      Milliseconds="500" />
   <wsrm:ExponentialBackoff />

 </wsrm:RMAssertion>

</wsp:Policy>
```

Element Description

beapolicy:Expires

Specifies an amount of time after which the reliable Web Service expires and does not accept any new sequences. Client applications invoking this instance of the reliable Web Service will receive an error if they try to invoke an operation after the expiration duration.

The default value of this element, if not specified in the WS-Policy file, is for the Web Service to never expires.

Table C-1 Attributes of <beapolicy:Expires>

Attribute	Description	Required?
Expires	The amount of time after which the reliable Web Service expires. The format of this attribute conforms to the XML Schema duration data type. For example, to specify that the reliable Web Service expires after 3 hours, specify `Expires="P3H"`.	Yes

beapolicy:QOS

Specifies the delivery assurance (or *Quality Of Service*) of the Web Service:

- **AtMostOnce**—Messages are delivered at most once, without duplication. It is possible that some messages may not be delivered at all.
- **AtLeastOnce**—Every message is delivered at least once. It is possible that some messages be delivered more than once.
- **ExactlyOnce**—Every message is delivered exactly once, without duplication.
- **InOrder**—Messages are delivered in the order that they were sent. This delivery assurance can be combined with the preceding three assurances.

The default value of this element, if not specified in the WS-Policy file, is `ExactlyOnce InOrder`.

Table C-2 Attributes of <beapolicy:QOS>

Attribute	Description	Required?
QOS	Specifies the delivery assurance. You can specify exactly one of the following values: • `AtMostOnce` • `AtLeastOnce` • `ExactlyOnce` You can also add the `InOrder` string to specify that the messages be delivered in order. If you specify one of the `XXXOnce` values, but do not specify `InOrder`, then the messages are *not* guaranteed to be in order. This is different from the default value if the entire QOS element is not specified (exactly once in order). Example: `<beapolicy:QOS QOS="AtMostOnce InOrder" />`	Yes

wsrm:AcknowledgementInterval

Specifies the maximum interval, in milliseconds, in which the destination endpoint must transmit a stand alone acknowledgement.

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 in a stand alone acknowledgement. In the case that a return message is not available to send an acknowledgement, a destination endpoint may wait for up to the acknowledgement interval before sending a stand alone acknowledgement. If there are no unacknowledged messages, the destination endpoint may choose not to send an acknowledgement.

This assertion does not alter the formulation of messages or acknowledgements as transmitted. Its purpose is to communicate the timing of acknowledgements so that the source endpoint may tune appropriately.

This element is optional. If you do not specify this element, the default value is set by the store and forward (SAF) agent configured for the destination endpoint.

Table C-3 Attributes of <wsrm:AcknowledgementInterval>

Attribute	Description	Required?
Milliseconds	Specifies the maximum interval, in milliseconds, in which the destination endpoint must transmit a stand alone acknowledgement.	Yes.

wsrm:BaseRetransmissionInterval

Specifies the interval, in milliseconds, that the source endpoint waits after transmitting a message and before it retransmits the message.

If the source endpoint does not receive an acknowledgement for a given message within the interval specified by this element, 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 assertion does not alter the formulation of messages as transmitted, only the timing of their transmission.

This element can be used in conjunctions with the `<wsrm:ExponentialBackoff>` element to specify that the retransmission interval will be adjusted using the algorithm specified by the `<wsrm:ExponentialBackoff>` element.

This element is optional. If you do not specify this element, the default value is set by the store and forward (SAF) agent configured for the source endpoint. If using the Administration Console to configure the SAF agent, this value is labeled Retry Delay Base.

Table C-4 Attributes of <wsrm:BaseRetransmissionInterval>

Attribute	Description	Required?
Milliseconds	Number of milliseconds the source endpoint waits to retransmit message.	Yes.

wsrm:ExponentialBackoff

Specifies that the retransmission interval will be adjusted using the exponential backoff algorithm.

This element is used in conjunction with the `<wsrm:BaseRetransmissionInterval>` element. If a destination endpoint does not acknowledge a sequence of messages for the amount of time specified by `<wsrm:BaseRetransmissionInterval>`, the exponential backoff algorithm will be used for timing of 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 in the WS-Policy file, successive retransmission intervals if messages continue to be unacknowledged are 2, 4, 8, 16, 32, and so on.

This element is optional. If not set, the same retransmission interval is used in successive retries, rather than the interval increasing exponentially.

This element has no attributes.

wsrm:InactivityTimeout

Specifies (in milliseconds) a period of inactivity for a sequence of messages. A sequence of messages is defined as a set of messages, identified by a unique sequence number, for which a particular delivery assurance applies; typically a sequence originates from a single source endpoint. If, during the duration specified by this element, a destination endpoint has received no messages from the source endpoint, the destination endpoint may consider the sequence to have been terminated due to inactivity. The same applies to the source endpoint.

This element is optional. If it is not set in the WS-Policy file, then sequences never time-out due to inactivity.

Table C-5 Attributes of <wsrm:InactivityTimeout>

Attribute	Description	Required?
Milliseconds	The number of milliseconds that defines a period of inactivity.	Yes.

wsrm:RMAssertion

Main Web Service reliable messaging assertion that groups all the other assertions under a single element.

The presence of this assertion in a WS-Policy file indicates that the corresponding Web Service must be invoked reliably.

Table C-6 Attributes of <wsrm:RMAssertion>

Attribute	Description	Required?
optional	Specifies whether the Web Service requires the operations to be invoked reliably. Valid values for this attribute are `true` and `false`. Default value is `false`.	No.

Security Policy Assertion Reference

The following sections provide reference information about the security assertions you can configure in a WS-Policy file:

- "Overview of a WS-Policy File That Contains Security Assertions" on page D-1
- "Graphical Representation" on page D-2
- "Example of a Policy File With Security Elements" on page D-4
- "Element Description" on page D-5
- "Using MessageParts To Specify Parts of the SOAP Messages that Must Be Encrypted or Signed" on page D-17

Overview of a WS-Policy File That Contains Security Assertions

You use WS-Policy files to configure the messgae-level security of a WebLogic Web Service. Use the `@Policy` and `@Policies` JWS annotations in the JWS file that implements the Web Service to specify the name of the WS-Policy file that is associated with a WebLogic Web Service.

A WS-Policy file is an XML file that conforms to the WS-Policy specification. The root element of a WS-Policy file is always `<wsp:Policy>`. To configure message-level security, you add policy assertions that specify the type of tokens supported for authentication and how the SOAP messages should be encrypted and digitally signed.

Note: These security policy assertions are *based* on the assertions described in the December 18, 2002 version of the *Web Services Security Policy Language* (WS-SecurityPolicy) specification. This means that although the exact syntax and usage of the assertions in WebLogic Server are different, they are similar in meaning to those described in the specification. The assertions in this release of WebLogic Server are *not* based on the latest update of the specification (13 July 2005.)

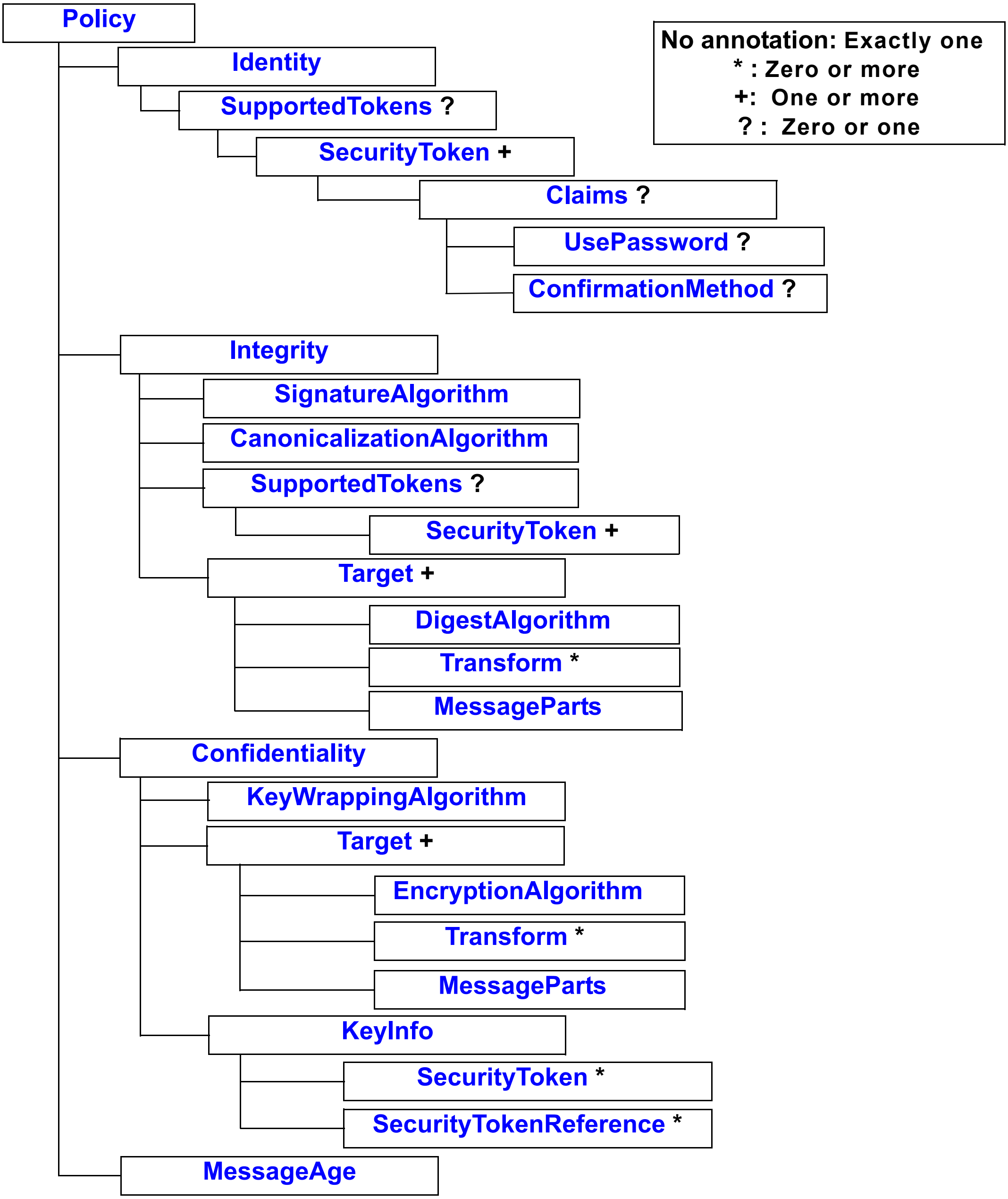
WebLogic Server includes three WS-Policy files (`Auth.xml`, `Sign.xml`, and `Encrypt.xml`) that contain typical security assertions that you can use if you do not want to create your own WS-Policy file. For details about these files, see "Using WS-Policy Files for Message-Level Security Configuration" on page 10-4.

See "Configuring Message-Level Security (Digital Signatures and Encryption)" on page 10-2 for task-oriented information about creating a message-level secured WebLogic Web Service.

Graphical Representation

The following graphic describes the element hierarchy of the security assertions in a WS-Policy file.

Figure 13-2 Element Hierarchy of Security WS-Policy Assertions



Example of a Policy File With Security Elements

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-
utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >

  <wssp:Identity>
    <wssp:SupportedTokens>
      <wssp:SecurityToken
TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml-token-pro
file-1.0#SAMLAssertionID">
        <wssp:Claims>
          <wssp:ConfirmationMethod>sender-vouches</wssp:ConfirmationMethod>
        </wssp:Claims>
      </wssp:SecurityToken>
    </wssp:SupportedTokens>
  </wssp:Identity>

  <wssp:Confidentiality>
    <wssp:KeyWrappingAlgorithm
          URI="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>

    <wssp:Target>
      <wssp:EncryptionAlgorithm
          URI="http://www.w3.org/2001/04/xmlenc#tripledes-cbc"/>
      <wssp:MessageParts
          Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
          wls:SecurityHeader(Assertion)
      </wssp:MessageParts>
    </wssp:Target>

    <wssp:Target>
      <wssp:EncryptionAlgorithm
          URI="http://www.w3.org/2001/04/xmlenc#tripledes-cbc"/>

      <wssp:MessageParts
          Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
          wsp:Body()</wssp:MessageParts>
    </wssp:Target>

    <wssp:KeyInfo />
  </wssp:Confidentiality>
```

```
</wsp:Policy>
```

Element Description

CanonicalizationAlgorithm

Specifies the algorithm used to canonicalize the SOAP message elements that are digitally signed.

Note: The WebLogic Web Services security runtime does not support specifing an *InclusiveNamespaces PrefixList* that contains a list of namespace prefixes or a token indicating the presence of the default namespace to the canonicalization algorithm.

Table D-1 Attributes of <CanonicalizationAlgorithm>

Attribute	Description	Required?
URI	The algorithm used to canonicalize the SOAP message being signed. You can specify only the following canonicalization algorithm: `http://www.w3.org/2001/10/xml-exc-c14n#`	Yes.

Claims

Specifies additional metadata information that is associated with a particular type of security token. Depending on the type of security token, you can or must specify the following child elements:

- For username tokens, you can define a <`UsePassword`> child element to specify whether you want the SOAP messages to use password digests.
- For SAML tokens, you must define a <`ConfirmationMethod`> child element to specify the type of SAML confirmation (`sender-vouches` or `holder-of-key`).

This element has no attributes.

Confidentiality

Specifies that part or all of the SOAP message must be encrypted, as well as the algorithms and keys that are used to encrypt the SOAP message.

For example, a Web Service may require that the entire body of the SOAP message must be encrypted using triple-DES.

This element has no attributes.

ConfirmationMethod

Specifies the type of confirmation method that is used when using SAML tokens for identity. You must specify one of the following two values for this element: `sender-vouches` or `holder-of-key`. For example:

```
<wssp:Claims>
       <wssp:ConfirmationMethod>sender-vouches</wssp:ConfirmationMethod>
</wssp:Claims>
```

This element has no attributes.

The `<ConfirmationMethod>` element is required *only* if you are using SAML tokens.

The exact location of the `<ConfirmationMethod>` assertion in the WS-Policy file depends on the type configuration method you are configuring. In particular:

sender-vouches:

Specify the `<ConfirmationMethod>` assertion within an `<Identity>` assertion, as shown in the following example:

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-w
ssecurity-utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part"
  >

  <wssp:Identity>
    <wssp:SupportedTokens>
      <wssp:SecurityToken

TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml
-token-profile-1.0#SAMLAssertionID">
        <wssp:Claims>

<wssp:ConfirmationMethod>sender-vouches</wssp:ConfirmationMethod>
        </wssp:Claims>
```

```
        </wssp:SecurityToken>
      </wssp:SupportedTokens>
    </wssp:Identity>

</wsp:Policy>
```

holder-of-key:

Specify the `<ConfirmationMethod>` assertion within an `<Integrity>` assertion. The reason you put the SAML token in the `<Integrity>` assertion for this confirmation method is that the Web Service runtime must prove the integrity of the message, which is not required by `sender-vouches`.

For example:

```
<?xml version="1.0"?>

<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-w
ssecurity-utility-1.0.xsd"
  xmlns:wls="http://www.bea.com/wls90/security/policy/wsee#part">

  <wssp:Integrity>
    <wssp:SignatureAlgorithm
       URI="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
    <wssp:CanonicalizationAlgorithm
       URI="http://www.w3.org/2001/10/xml-exc-c14n#"/>

    <wssp:Target>
      <wssp:DigestAlgorithm
         URI="http://www.w3.org/2000/09/xmldsig#sha1" />
      <wssp:MessageParts
         Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
         wsp:Body()
      </wssp:MessageParts>
    </wssp:Target>

    <wssp:SupportedTokens>
      <wssp:SecurityToken
          IncludeInMessage="true"

TokenType="http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml
-token-profile-1.0#SAMLAssertionID">
        <wssp:Claims>

<wssp:ConfirmationMethod>holder-of-key</wssp:ConfirmationMethod>
        </wssp:Claims>
      </wssp:SecurityToken>
```

```
            </wssp:SupportedTokens>
          </wssp:Integrity>
     </wsp:Policy>
```

For more information about the two SAML confirmation methods (`sender-vouches` or `holder-of-key`), see SAML Token Profile Support in WebLogic Web Services.

DigestAlgorithm

Specifies the digest algorithm that is used when digitally signing the specified parts of a SOAP message. Use the <MessageParts> sibling element to specify the parts of the SOAP message you want to digitally sign.

Table D-2 Attributes of <DigestAlgorithm>

Attribute	Description	Required?
URI	The digest algorithm that is used when digitally signing the specified parts of a SOAP message. You can specify only the following digest algorithm: `http://www.w3.org/2000/09/xmldsig#sha1`	Yes.

EncryptionAlgorithm

Specifies the encryption algorithm that is used when encrypting the specified parts of a SOAP message. Use the <MessageParts> sibling element to specify the parts of the SOAP message you want to digitally sign.

Table D-3 Attributes of <EncryptionAlgorithm>

Attribute	Description	Required?

URI	The encryption algorithm used to encrypt specified parts of the SOAP message.
	Valid values are:
	`http://www.w3.org/2001/04/xmlenc#tripledes-cbc`
	`http://www.w3.org/2001/04/xmlenc#kw-tripledes`
		Yes.

Identity

Specifies the type of security tokens (username, X.509, or SAML) that are supported for authentication.

This element has no attributes.

Integrity

Specifies that part or all of the SOAP message must be digitally signed, as well as the algorithms and keys that are used to sign the SOAP message.

For example, a Web Service may require that the entire body of the SOAP message must be digitally signed and only algorithms using SHA1 and an RSA key are accepted.

Table D-4 Attributes of <Integrity>

Attribute	Description	Required?
SignToken	Specifies whether the security token, specified using the `<SecurityToken>` child element of `<Integrity>`, should also be digitally signed, in addition to the specified parts of the SOAP message. The valid values for this attribute are `true` and `false`. The default values is `true`.	No.

KeyInfo

Used to specify the security tokens that are used for encryption.

This element has no attributes.

KeyWrappingAlgorithm

Specifies the algorithm used to encrypt the message encryption key.

Table D-5 Attributes of <KeyWrappingAlgorithm>

Attribute	Description	Required?
URI	The algorithm used to encrypt the SOAP message encryption key. Valid values are: • `http://www.w3.org/2001/04/xmlenc#rsa-1_5` (to specify the RSA-v1.5 algorithm) • `http://www.w3.org/2001/04/xmlenc#rsa-oaep-mgf1p` (to specify the RSA-OAEP algorithm)	Yes.

MessageAge

Specifies the acceptable time period before SOAP messages are declared stale and discarded.

When you include this security assertion in your WS-Policy file, the Web Services runtime adds a `<Timestamp>` header to the request or response SOAP message, depending on the direction (inbound, outbound, or both) to which the WS-Policy file is associated. The `<Timestamp>` header indicates to the recipient of the SOAP message when the message expires.

For example, assume that your WS-Policy file includes the following `<MessageAge>` assertion:

```
<wsp:Policy
  xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wssp="http://www.bea.com/wls90/security/policy"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wsse
curity-utility-1.0.xsd"
  >
...
   <wssp:MessageAge Age="300" />

</wsp:Policy>
```

The resulting generated SOAP message will have a `<Timestamp>` header similar to the following excerpt:

```
<wsu:Timestamp
     wsu:Id="Dy2PFsX3ZQacqNKEANpXbNMnMhm2BmGOA2WDc2E0JpiaaTmbYNwT"

xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wsse
curity-utility-1.0.xsd">
```

```
    <wsu:Created>2005-11-09T17:46:55Z</wsu:Created>
    <wsu:Expires>2005-11-09T17:51:55Z</wsu:Expires>
</wsu:Timestamp>
```

In the example, the recipient of the SOAP message discards the message if received after `2005-11-09T17:51:55Z`, or five minutes after the message was created.

The Web Services runtime, when generating the SOAP message, sets the `<Created>` header to the time when the SOAP message was created and the `<Expires>` header to the creation time plus the value of the `Age` attribute of the `<MessageAge>` assertion.

The following table describes the attributes of the `<MessageAge>` assertion.

Table D-6 Attributes of <MessageAge>

Attribute	Description	Required?
Age	Specifies the actual maximum age time-out for a SOAP message, in seconds.	No.

The following table lists the properties that describe the timestamp behavior of the WebLogic Web Services security runtime, along with their default values.

Table 13-2 Timestamp Behavior Properties

Property	Description	Default Value
Clock Synchronized	Specifies whether the Web Service assumes synchronized clocks.	true
Clock Precision	If clocks are synchronized, describes the accuracy of the synchronization.	60000 milliseconds
Lax Precision	Allows you to relax the enforcement of the clock precision property.	false
Max Processing Delay	Specifies the freshness policy for received messages.	-1
Validity Period	Represents the length of time the sender wants the outbound message to be valid.	60 seconds

You typically never need to change the values of the preceding timestamp properties. However, if you do need to, you must use the Administration Console to create the `default_wss` Web Service Security Configuration, if it does not already exist, and then update its timestamp configuration by clicking on the **Timestamp** tab. See Create a Web Service security configuration for task information and Domains: Web Services Security: Timestamp for additional reference information about these timestamp properties.

MessageParts

Specifies the parts of the SOAP message that should be signed or encrypted, depending on the grand-parent of the element. You can use either an XPath 1.0 expression or a set of pre-defined functions within this assertion to specify the parts of the SOAP message.

The `MessageParts` assertion is always a child of a `Target` assertion. The `Target` assertion can be a child of either an `Integrity` assertion (to specify how the SOAP message is digitally signed) or a `Confidentiality` assertion (to specify how the SOAP messages are encrypted.)

See "Using MessageParts To Specify Parts of the SOAP Messages that Must Be Encrypted or Signed" on page D-17 for detailed information about using this assertion, along with a variety of examples.

Table D-7 Attributes of <MessageParts>

Attribute	Description	Required?
Dialect	Identifies the dialect used to identity the parts of the SOAP message that should be signed or encrypted. If this attribute is not specified, then XPath 1.0 is assumed. The value of this attribute must be one of the following: • `http://www.w3.org/TR/1999/REC-xpath-19991116` : Specifies that an XPath 1.0 expression should be used against the SOAP message to specify the part to be signed or encrypted. • `http://schemas.xmlsoap.org/2002/12/wsse#part` : Convenience dialect used to specify that the entire SOAP body should be signed or encrypted. • `http://www.bea.com/wls90/security/policy/wsee#part` : Convenience dialect to specify that the WebLogic-specific headers should be signed or encrypted. You can also use this dialect to use QNames to specify the parts of the security header that should be signed or encrypted. See "Using MessageParts To Specify Parts of the SOAP Messages that Must Be Encrypted or Signed" on page D-17 for examples of using these dialects.	Yes.

SecurityToken

Specifies the security token that is supported for authentication, encryption or digital signatures, depending on the parent element.

For example, if this element is defined in the `<Identity>` parent element, then is specifies that a client application, when invoking the Web Service, must attach a security token to the SOAP request. For example, a Web Service might require that the client application present a SAML authorization token issued by a trusted authorization authority for the Web Service to be able to access sensitive data. If this element is part of `<Confidentiality>`, then it specifies the token used for encryption.

The specific type of the security token is determined by the value of its `TokenType` attribute, as well as its parent element.

Table D-8 Attributes of <SecurityToken>

Attribute	Description	Required?
IncludeInMessage	Specifies whether to include the token in the SOAP message. Valid values are `true` or `false`. The default value of this attribute is `false` when used in the `<Confidentiality>` assertion and `true` when used in the `<Integrity>` assertion. The value of this attribute is *always* `true` when used in the `<Identity>` assertion, even if you explicitly set it to `false`.	No.
TokenType	Specifies the type of security token. Valid values are: • `http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#X509v3` (To specify a binary X.509 token) • `http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#UsernameToken` (To specify a username token) • `http://docs.oasis-open.org/wss/2004/01/oasis-2004-01-saml-token-profile-1.0#SAMLAssertionID` (To specify a SAML token)	Yes.

SecurityTokenReference

For internal use only.

You should never include this security assertion in your custom WS-Policy file; it is described in this section for informational purposes only. The WebLogic Web Services runtime automatically inserts this security assertion in the WS-Policy file that is published in the dynamic WSDL of the deployed Web Service. The security assertion specifies WebLogic Server's public key; the client application that invokes the Web Service then uses it to encrypt the parts of the SOAP message specified by the WS-Policy file. The Web Services runtime then uses the server's private key to decrypt the message.

SignatureAlgorithm

Specifies the cryptographic algorithm used to compute the digital signature.

Table D-9 Attributes of <SignatureAlgorithm>

Attribute	Description	Required?

URI	Specifies the cryptographic algorithm used to compute the signature.
	Note: Be sure that you specify an algorithm that is compatible with the certificates you are using in your enterprise.
	Valid values are:
	`http://www.w3.org/2000/09/xmldsig#rsa-sha1`
	`http://www.w3.org/2000/09/xmldsig#dsa-sha1`
		Yes.

SupportedTokens

Specifies the list of supported security tokens that can be used for authentication, encryption, or digital signatures, depending on the parent element.

This element has no attributes.

Target

Encapsulates information about which targets of a SOAP message are to be encrypted or signed, depending on the parent element.

The child elements also depend on the parent element; for example, when used in `<Integrity>`, you can specify the `<DigestAlgorithm>`, `<Transform>`, and `<MessageParts>` child elements. When used in `<Confidentiality>`, you can specify the `<EncryptionAlgorithm>`, `<Transform>`, and `<MessageParts>` child elements.

You can have one or more targets.

Table D-10 Attributes of <Target>

Attribute	Description	Required?
encryptContent Only	Specifies whether to encrypt an entire element, or just its content. This attribute can be specified only when `<Target>` is a child element of `<Confidentiality>`. Default value of this attribute is `true`, which means that only the content is encrypted.	No.

Transform

Specifies the URI of a transformation algorithm that is applied to the parts of the SOAP message that are signed or encrypted, depending on the parent element.

You can specify zero or more transforms, which are executed in the order they appear in the `<Target>` parent element.

Table D-11 Attributes of <Transform>

Attribute	Description	Required?
URI	Specifies the URI of the transformation algorithm. Valid URIs are: • `http://www.w3.org/2000/09/xmldsig#base64` (Base64 decoding transforms) • `http://www.w3.org/TR/1999/REC-xpath-19991116` (XPath filtering) For detailed information about these transform algorithms, see XML-Signature Syntax and Processing.	Yes.

UsePassword

Specifies that whether the plaintext or the digest of the password appear in the SOAP messages. This element is used only with username tokens.

Table D-12 Attributes of <UsePassword>

Attribute	Description	Required?
Type	Specifies the type of password. Valid values are: • `http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText` : Specifies that cleartext passwords should be used in the SOAP messages. • `http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordDigest` : Specifies that password digests should be used in the SOAP messages. **Note:** For backward compatibility reasons, the two preceding URIs can also be specified with an initial "www." For example: • `http://www.docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText` • `http://www.docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordDigest`	Yes.

Using MessageParts To Specify Parts of the SOAP Messages that Must Be Encrypted or Signed

When you use either the `Integrity` or `Confidentiality` assertion in your WS-Policy file, you are required to also use the `Target` child assertion to specify the targets of the SOAP message to digitally sign or encrypt. The `Target` assertion in turn requires that you use the `MessageParts` child assertion to specify the actual parts of the SOAP message that should be digitally signed or encrypted. This section describes various ways to use the `MessageParts` assertion.

See "Example of a Policy File With Security Elements" on page D-4 for an example of a complete WS-Policy file that uses the `MessageParts` assertion within a `Confidentiality` assertion. The example shows how to specify that the entire body, as well as the `Assertion` security header, of the SOAP messages should be encrypted.

You use the `Dialect` attribute of `MessageParts` to specify the dialect used to identify the SOAP message parts. The WebLogic Web Services security runtime supports the following three dialects:

- XPath 1.0
- Pre-Defined wsp:Body() Function
- WebLogic-Specific Header Functions

Be sure that you specify a message part that actually exists in the SOAP messages that result from a client invoke of a message-secured Web Service. If the Web Services security runtime encounters an inbound SOAP message that does not include a part that the WS-Policy file indicates should be signed or encrypted, then the Web Services security runtime returns an error and the invoke fails. The only exception is if you use the WebLogic-specific `wls:SystemHeader()` function to specify that any WebLogic-specific SOAP header in a SOAP message should be signed or encrypted; if the Web Services security runtime does not find any of these headers in the SOAP message, the runtime simply continues with the invoke and does not return an error.

XPath 1.0

This dialect enables you to use an XPath 1.0 expression to specify the part of the SOAP message that should be signed or encrypted. The value of the `Dialect` attribute to enable this dialect is `http://www.w3.org/TR/1999/REC-xpath-19991116`.

You typically want to specify that the parts of a SOAP message that should be encrypted or digitally signed are child elements of either the `soap:Body` or `soap:Header` elements. For this reason, BEA provides the following two functions that take as parameters an XPath expression:

- `wsp:GetBody(`*`xpath_expression`*`)`—Specifies that the root element from which the XPath expression starts searching is `soap:Body`.
- `wsp:GetHeader(`*`xpath_expression`*`)`—Specifies that the root element from which the XPath expression starts searching is `soap:Header`.

You can also use a plain XPath expression as the content of the `MessageParts` assertion, without one of the preceding functions. In this case, the root element from which the XPath expression starts searching is `soap:Envelope`.

The following example specifies that the `AddInt` part, with namespace prefix `n1` and located in the SOAP message body, should be signed or encrypted, depending on whether the parent `Target` parent is a child of `Integrity` or `Confidentiality` assertion:

```
<wssp:MessageParts
     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116"
     xmlns:n1="http://www.bea.com/foo">
```

```
        wsp:GetBody(./n1:AddInt)
</wssp:MessageParts>
```

The preceding example shows that you should define the namespace of a part specified in the XPath expression (`n1` in the example) as an attribute to the `MessageParts` assertion, if you have not already defined the namespace elsewhere in the WS-Policy file.

The following example is similar, except that the part that will be signed or encrypted is `wsu:Timestamp`, which is a child element of `wsee:Security` and is located in the SOAP message header:

```
<wssp:MessageParts
     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">
        wsp:GetHeader(./wsse:Security/wsu:Timestamp)
</wssp:MessageParts>
```

In the preceding example, it is assumed that the `wsee:` and `wse:` namespaces have been defined elsewhere in the WS-Policy file.

Note: It is beyond the scope of this document to describe how to create XPath expressions. For detailed information, see the XML Path Language (XPath), Version 1.0, specification.

Pre-Defined wsp:Body() Function

The XPath dialect described in "XPath 1.0" on page D-18 is flexible enough for you to pinpoint any part of the SOAP message that should be encrypted or signed. However, sometimes you might just want to specify that the *entire* SOAP message body be signed or encrypted. In this case using an XPath expression is unduly complicated, so BEA recommends you use the dialect that pre-defines the `wsp:Body()` function for just this purpose, as shown in the following example:

```
<wssp:MessageParts
     Dialect="http://schemas.xmlsoap.org/2002/12/wsse#part">
       wsp:Body()
</wssp:MessageParts>
```

WebLogic-Specific Header Functions

BEA provides its own dialect that pre-defines a set of functions to easily specify that some or all of the WebLogic security or system headers should be signed or encrypted. Although you can achieve the same goal using the XPath dialect, it is much simpler to use this WebLogic dialect. You enable this dialect by setting the `Dialect` attribute to `http://www.bea.com/wls90/security/policy/wsee#part`.

The `wls:SystemHeaders()` function specifies that all of the WebLogic-specific headers should be signed or encrypted. These headers are used internally by the WebLogic Web Services runtime for various features, such as reliable messaging and addressing. The headers are:

- `wsrm:SequenceAcknowledgement`
- `wsrm:AckRequested`
- `wsrm:Sequence`
- `wsa:Action`
- `wsa:FaultTo`
- `wsa:From`
- `wsa:MessageID`
- `wsa:RelatesTo`
- `wsa:ReplyTo`
- `wsa:To`
- `wsax:SetCookie`
- `wsu:Timestamp`

The following example shows how to use the `wls:SystemHeader()` function:

```
<wssp:MessageParts
     Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
        wls:SystemHeaders()
</wssp:MessageParts>
```

Use the `wls:SecurityHeader(`*`header`*`)` function to specify a particular part in the security header that should be signed or encrypted, as shown in the following example:

```
<wssp:MessageParts
    Dialect="http://www.bea.com/wls90/security/policy/wsee#part">
        wls:SecurityHeader(wsu:Timestamp)
</wssp:MessageParts>
```

In the example, only the `wsu:Timestamp` security header is signed or encrypted. You can specify any of the preceding list of headers to the `wls:SecurityHeader()` function.

WebLogic Web Service Deployment Descriptor Element Reference

The following sections provide information about the WebLogic-specific Web Services deployment descriptor file, `weblogic-webservices.xml`:

- "Overview of weblogic-webservices.xml" on page E-1
- "Graphical Representation" on page E-2
- "XML Schema" on page E-4
- "Example of a weblogic-webservices.xml Deployment Descriptor File" on page E-4
- "Element Description" on page E-4

Overview of weblogic-webservices.xml

The standard J2EE deployment descriptor for Web Services is called `webservices.xml`. This file specifies the set of Web Services that are to be deployed to WebLogic Server and the dependencies they have on container resources and other services. See the Web Services XML Schema for a full description of this file.

The WebLogic equivalent to the standard J2EE `webservices.xml` deployment descriptor file is called `weblogic-webservices.xml`. This file contains WebLogic-specific information about a WebLogic Web Service, such as the URL used to invoke the deployed Web Service, and so on.

Both deployment descriptor files are located in the same location on the J2EE archive that contains the Web Service. In particular:

- For Java class-implemented Web Services, the Web Service is packaged as a Web application WAR file and the deployment descriptors are located in the WEB-INF directory.
- For stateless session EJB-implemented Web Services, the Web Service is packaged as an EJB JAR file and the deployment descriptors are located in the META-INF directory.

The structure of the `weblogic-webservices.xml` file is similar to the structure of the J2EE `webservices.xml` file in how it lists and identifies the Web Services that are contained within the archive. For example, for each Web Service in the archive, both files have a `<webservice-description>` child element of the appropriate root element (`<webservices>` for the J2EE `webservices.xml` file and `<weblogic-webservices>` for the `weblogic-webservices.xml` file)

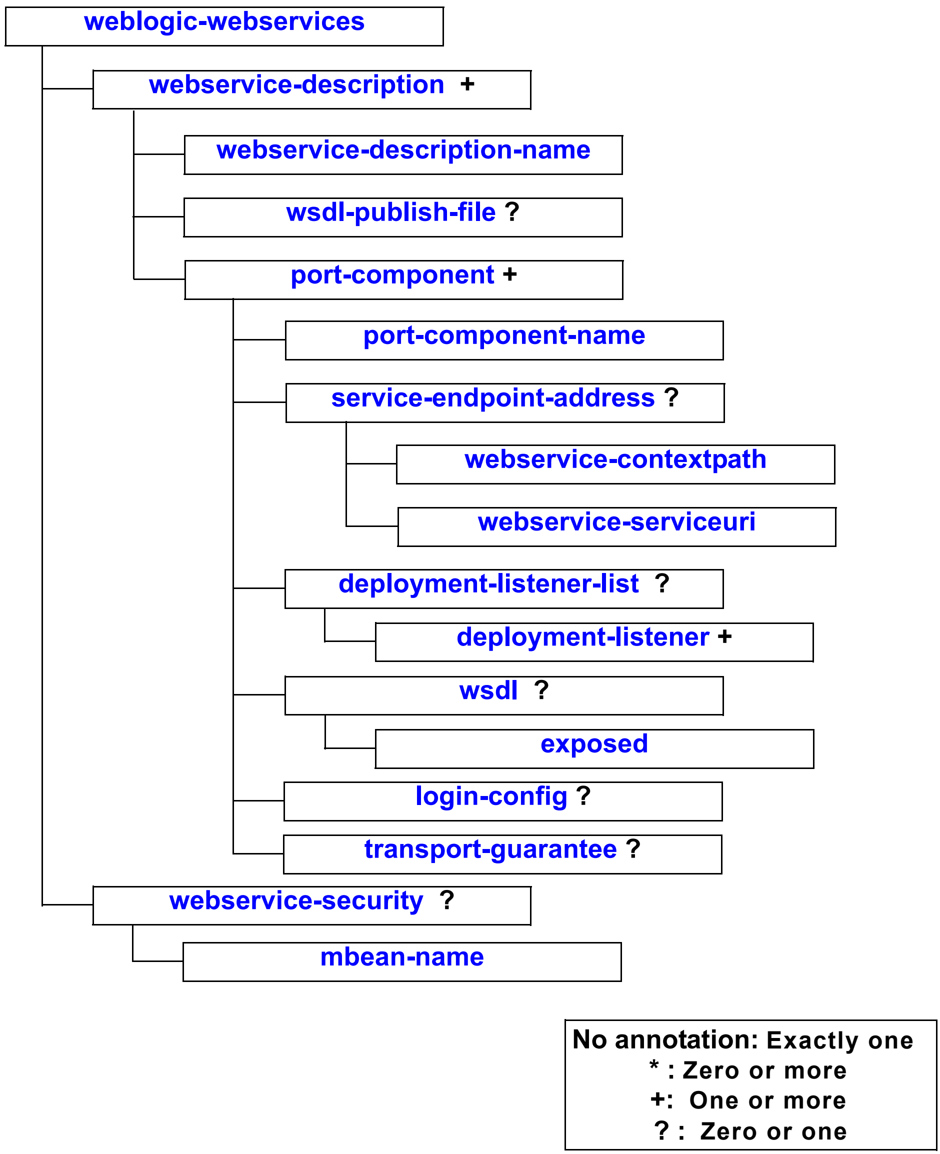
Typically users *never* need to update either deployment descriptor files, because the `jwsc` Ant task automatically generates the files for you based on the value of the JWS annotations in the JWS file that implements the Web Service. For this reason, this section is published for informational purposes only.

The data type definitions of two elements in the `weblogic-webservices.xml` file (login-config and transport-guarantee) are imported from the J2EE Schema for the `web.xml` file. See the Servlet Deployment Descriptor Schema for details about these elements and data types.

Graphical Representation

The following graphic describes the element hierarchy of the `weblogic-webservices.xml` deployment descriptor file.

Figure 13-3 Element Hierarchy of weblogic-webservices.xml



XML Schema

For the XML Schema file that describes the `weblogic-webservices.xml` deployment descriptor, see http://www.bea.com/ns/weblogic/90/weblogic-wsee.xsd.

Example of a weblogic-webservices.xml Deployment Descriptor File

The following example shows a simple `weblogic-webservices.xml` deployment descriptor:

```
<?xml version='1.0' encoding='UTF-8'?>
<weblogic-webservices xmlns="http://www.bea.com/ns/weblogic/90">

  <webservice-description>
   <webservice-description-name>MyService</webservice-description-name>
    <port-component>
      <port-component-name>MyServiceServicePort</port-component-name>
      <service-endpoint-address>
        <webservice-contextpath>/MyService</webservice-contextpath>
        <webservice-serviceuri>/MyService</webservice-serviceuri>
      </service-endpoint-address>
    </port-component>
  </webservice-description>

</weblogic-webservices>
```

Element Description

deployment-listener-list

For internal use only.

deployment-listener

For internal use only.

exposed

Boolean attribute indicating whether the WSDL should be exposed to the public when the Web Service is deployed.

login-config

The j2ee:login-config element specifies the authentication method that should be used, the realm name that should be used for this application, and the attributes that are needed by the form login mechanism.

The XML Schema data type of the j2ee:login-config element is j2ee:login-configType, and is defined in the J2EE Schema that describes the standard web.xml deployment descriptor. For the full reference information, see http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd.

mbean-name

Specifies the name of the Web Service security configuration (specifically an instantiation of the WebserviceSecurityMBean) that is associated with the Web Services described in the deployment descriptor file. The default configuration is called default_wss.

The associated security configuration specifies information such as whether to use an X.509 certificate for identity, whether to use password digests, the keystore to be used for encryption and digital signatures, and so on.

You must create the security configuration (even the default one) using the Administration Console before you can successfully invoke the Web Service.

Note: The Web Service security configuration described by this element applies to *all* Web Services contained in the weblogic-webservices.xml file. The jwsc Ant task always packages a Web Service in its own JAR or WAR file, so this limation is not an issue if you always use the jwsc Ant task to generate a Web Service. However, if you update the weblogic-webservices.xml deployment descriptor manually and add additional Web Service descriptions, you cannot associate different security configurations to different services.

port-component

The <port-component> element is a holder of other elements used to describe a Web Service port.

The child elements of the <port-component> element specify WebLogic-specific characteristics of the Web Service port, such as the context path and service URI used to invoke the Web Service after it has been deployed to WebLogic Server.

port-component-name

The <port-component-name> child element of the <port-component> element specifies the internal name of the WSDL port.

The value of this element must be unique for all <port-component-name> elements within a single weblogic-webservices.xml file.

service-endpoint-address

The <service-endpoint-address> element groups the WebLogic-specific context path and service URI values that together make up the Web Service endpoint address, or the URL that invokes the Web Service after it has been deployed to WebLogic Server.

These values are specified with the <webservice-contextpath> and <webserivce-serviceuri> child elements.

transport-guarantee

The j2ee:transport-guarantee element specifies the type of communication between the client application invoking the Web Service and WebLogic server.

The value of this element is either NONE, INTEGRAL, or CONFIDENTIAL. NONE means that the application does not require any transport guarantees. A value of INTEGRAL means that the application requires that the data sent between the client and server be sent in such a way that it cannot be changed in transit. CONFIDENTIAL means that the application requires that the data be transmitted in a way that prevents other entities from observing the contents of the transmission. In most cases, the presence of the INTEGRAL or CONFIDENTIAL flag indicates that the use of SSL is required.

The XML Schema data type of the j2ee:transport-guarantee element is j2ee:transport-guaranteeType, and is defined in the J2EE Schema that describes the standard web.xml deployment descriptor. For the full reference information, see http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd.

weblogic-webservices

The <weblogic-webservices> element is the root element of the WebLogic-specific Web Services deployment descriptor (weblogic-webservices.xml).

The element specifies the set of Web Services contained in the J2EE component archive in which the deployment descriptor is also contained. The archive is either an EJB JAR file (for stateless session EJB-implemented Web Services) or a WAR file (for Java class-implemented Web Services)

webservice-contextpath

The `<webservice-contextpath>` element specifies the context path portion of the URL used to invoke the Web Service.

The URL to invoke a Web Service deployed to WebLogic Server is:

```
http://host:port/contextPath/serviceURI
```

where

- *host* is the host computer on which WebLogic Server is running.
- *port* is the port address to which WebLogic Server is listening.
- *contextPath* is the value of this element
- *serviceURI* is the value of the webservice-serviceuri element.

When using the `jwsc` Ant task to generate a Web Service from a JWS file, the value of the `<webservice-contextpath>` element is taken from the `contextPath` attribute of the WebLogic-specific `@WLHttpTransport` annotation or the `<WLHttpTransport>` child element of `jwsc`.

webservice-description

The `<webservice-description>` element is a holder of other elements used to describe a Web Service.

The `<webservice-description>` element defines a set of port components (specified using one or more `<port-component>` child elements) that are associated with the WSDL ports defined in the WSDL document.

There may be multiple `<webservice-description>` elements defined within a single `weblogic-webservices.xml` file, each corresponding to a particular stateless session EJB or Java class contained within the archive, depending on the implementation of your Web Service. In other words, an EJB JAR contains the EJBs that implement a Web Service, a WAR file contains the Java classes.

webservice-description-name

The `<webservice-description-name>` element specifies the internal name of the Web Service.

The value of this element must be unique for all `<webservice-description-name>` elements within a single `weblogic-webservices.xml` file.

webservice-security

Element used to group together all the security-related elements of the `weblogic-webservices.xml` deployment descriptor.

webservice-serviceuri

The `<webservice-serviceuri>` element specifies the Web Service URI portion of the URL used to invoke the Web Service.

The URL to invoke a Web Service deployed to WebLogic Server is:

```
http://host:port/contextPath/serviceURI
```

where

- *host* is the host computer on which WebLogic Server is running.
- *port* is the port address to which WebLogic Server is listening.
- *contextPath* is the value of the webservice-contextpath element
- *serviceURI* is the value of this element.

When using the `jwsc` Ant task to generate a Web Service from a JWS file, the value of the `<webservice-serviceuri>` element is taken from the `serviceURI` attribute of the WebLogic-specific `@WLHttpTransport` annotation or the `<WLHttpTransport>` child element of `jwsc`.

wsdl

Element used to group together all the WSDL-related elements of the `weblogic-webservices.xml` deployment descriptor.

wsdl-publish-file

The `<wsdl-publish-file>` element specifies a directory (on the computer which hosts the Web Service) to which WebLogic Server should publish a hard-copy of the WSDL file of a deployed Web Service; this is in addition to the standard WSDL file accessible via HTTP.

For example, assume that your Web Service is implemented with an EJB, and its WSDL file is located in the following directory of the EJB JAR file, relative to the root of the JAR:

```
META-INF/wsdl/a/b/Fool.wsdl
```

Further assume that the `weblogic-webservices.xml` file includes the following element for a given Web Service:

```
<wsdl-publish-file>d:/bar</wsdl-publish-file>
```

This means that when WebLogic Server deploys the Web Service, the server publishes the WSDL file at the standard HTTP location, but also puts a copy of the WSDL file in the following directory of the computer on which the service is running:

```
d:/bar/a/b/Foo.wsdl
```

Warning: Only specify this element if client applications that invoke the Web Service need to access the WSDL via the local file system or FTP; typically, client applications access the WSDL using HTTP, as described in "Browsing to the WSDL of the Web Service" on page 4-15.

The value of this element should be an absolute directory pathname. This directory must exist on *every* machine which hosts a WebLogic Server instance or cluster to which you deploy the Web Service.