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Web Services Developer's Guide

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Preface

This guide describes how to use Oracle Application Server Web Services and the Oracle WebServicesAssembler tool to assemble Web services from a variety of resources: Java classes, EJBs, database resources, JMS destinations and J2SE 5.0 Annotations. You can also assemble REST-style Web services. The *Developers Guide* also describes how to assemble J2SE and J2EE clients to access these services. This book includes descriptions of the message formats and datatypes supported by OracleAS Web Services.

This preface contains these topics:

Intended Audience

Oracle Application Server Web Services Developer's Guide is intended for application programmers, system administrators, and other users who perform the following tasks:

- Assemble Web services from Java classes, EJBs, Database Resources, and JMS queues
- Assemble J2SE and J2EE Web service clients
- Work with SOAP messages in RPC-literal, RPC-encoded and document-literal formats

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Related Documents

For more information, see these Oracle resources:

- *Oracle Application Server Advanced Web Services Developer's Guide*

  This book describes topics beyond basic Web service assembly. For example, it describes how to diagnose common interoperability problems, how to enable Web service management features (such as reliability, auditing, and logging), and how to use custom serialization of Java value types.

  This book also describes how to employ the Web Service Invocation Framework (WSIF), the Web Service Provider API, message attachments, and management features (reliability, logging, and auditing). It also describes alternative Web service strategies, such as using JMS as a transport mechanism.

  For your convenience, "Contents of the Oracle Application Server Advanced Web Services Developer's Guide" on page xix lists the contents of the *Oracle Application Server Advanced Web Services Developer's Guide*.

- *Oracle Application Server Web Services Security Guide*

  This book describes the different security strategies that can be applied to a Web service in Oracle Application Server Web Services. The strategies that can be employed are username token, X.509 token, SAML token, XML encryption, and XML signature. The book describes the configuration options available for the client and the service, for inbound messages and outbound messages. It also describes how to configure these options for a number of different scenarios.

- *Oracle Containers for J2EE Security Guide*

  This book (not to be confused with the *Oracle Application Server 10g Security Guide*), describes security features and implementations particular to OC4J. This includes information about using JAAS, the Java Authentication and Authorization Service, as well as other Java security technologies.

- *Oracle Containers for J2EE Services Guide*

  This book provides information about standards-based Java services supplied with OC4J, such as JTA, JNDI, JMS, JAAS, and the Oracle Application Server Java Object Cache.

- *Oracle Containers for J2EE Configuration and Administration Guide*

This book describes how to configure and administer applications for OC4J, including use of the Oracle Enterprise Manager 10g Application Server Control Console, use of standards-compliant MBeans provided with OC4J, and, where appropriate, direct use of OC4J-specific XML configuration files.

- *Oracle Containers for J2EE Deployment Guide*

  This book covers information and procedures for deploying an application to an OC4J environment. This includes discussion of the deployment plan editor that comes with Oracle Enterprise Manager 10g.

- *Oracle Containers for J2EE Developer's Guide*

  This discusses items of general interest to developers writing an application to run on OC4J—issues that are not specific to a particular container such as the servlet, EJB, or JSP container. (An example is class loading.)

From the Oracle Application Server core documentation group:

- *Oracle Application Server Security Guide*
- *Oracle Application Server Administrator's Guide*
- *Oracle Application Server Certificate Authority Administrator's Guide*
- *Oracle Application Server Single Sign-On Administrator's Guide*
- *Oracle Application Server Enterprise Deployment Guide*

For Oracle Web Services Manager:

- *Oracle Web Services Manager User and Administrator Guide*
- *Oracle Web Services Manager Extensibility Guide*
- *Oracle Web Services Manager Installation and Deployment Guide*
- *Oracle Web Services Manager Upgrade Guide*

Printed documentation is available for sale in the Oracle Store at:

`http://oraclestore.oracle.com/`

Contents of the Oracle Application Server Advanced Web Services Developer's Guide

This book is designed to be used with the *Oracle Application Server Advanced Web Services Developer's Guide*. The "*Advanced*" book describes topics beyond basic Web service assembly.

For your convenience, the contents of the *Oracle Application Server Advanced Web Services Developer's Guide*. are listed here.

- Chapter 9, "Using Web Services Invocation Framework"
- Chapter 10, "Using Web Service Providers"
- Appendix A, "Understanding the Web Services Management Schema"
- Appendix B, "JAX-RPC Mapping File Descriptor"
- Appendix C, "Web Service MBeans"
- Appendix D, "Mapping Java Types to XML and WSDL Types"
- Appendix E, "Troubleshooting"

Links to Related Specifications

The following sections collate references to documentation that appear in the text of this manual:

- Java Technology Documents
- OC4J-Related Documents
- SOAP-Related Documents
- WSDL-Related Documents
- UDDI-Related Documents
- Encryption-Related Documents

Java Technology Documents

- Java 2 Platform Enterprise Edition (J2EE), version 1.4 API specification:

  `http://java.sun.com/j2ee/1.4/docs/api`

- XML Schemas for J2EE Deployment Descriptors lists the document formats used by the Java 2 Platform, Enterprise Edition (J2EE) deployment descriptors which are described by J2EE 1.4 and later specifications:

  `http://java.sun.com/xml/ns/j2ee/`

- J2EE client schema provides the XSD for a J2EE Web service client:

  `http://java.sun.com/xml/ns/j2ee/j2ee_web_services_client_1_1.xsd`

- Java API for XML-based RPC (JAX-RPC) to build Web applications and Web services. This functionality incorporates XML-based RPC functionality according to the SOAP 1.1 specification.

  `http://java.sun.com/webservices/jaxrpc/index.jsp`

- Java Servlet 2.4 specification:

  `http://www.jcp.org/aboutJava/communityprocess/final/jsr154/index.html`

OC4J-Related Documents

- A list of OC4J schemas, including proprietary deployment descriptors:

  `http://www.oracle.com/technology/oracleas/schema/index.html`

- Oracle UDDI v2.0 server implementation:

  `http://www.oracle.com/technology/tech/webservices/htdocs/uddi/index.html`

- *Oracle Database JPublisher User's Guide*

SOAP-Related Documents

- SOAP 1.1 and 1.2 specifications (main page):

  http://www.w3.org/TR/SOAP

- SOAP 1.1 specifications:
  - specification:

    http://www.w3.org/TR/2000/NOTE-SOAP-20000508/
  - SOAP 1.1 message encoding:

    http://schemas.xmlsoap.org/soap/encoding/
  - SOAP 1.1 binding schema:

    http://schemas.xmlsoap.org/wsdl/soap/2003-02-11.xsd

    The SOAP 1.2 binding schema is identical to the SOAP 1.1 binding schema, except that the target namespace is:

    http://schemas.xmlsoap.org/wsdl/soap12/

- SOAP 1.2 specification:
  - SOAP 1.2 Part 1: Primer:

    http://www.w3.org/TR/soap12-part0/
  - SOAP 1.2 Part 1: Messaging Format:

    http://www.w3.org/TR/soap12-part1/
  - SOAP 1.2 Part 2 Recommendation (Adjuncts):

    http://www.w3.org/TR/soap12-part2/
  - SOAP 1.2 message encoding:

    http://www.w3.org/2003/05/soap-encoding/
  - HTTP transport for SOAP 1.2:

    http://www.w3.org/2003/05/soap/bindings/HTTP
  - SOAP binding schema:

    http://schemas.xmlsoap.org/wsdl/soap/2003-02-11.xsd
  - Definition of the fault code element in the SOAP schema:

    http://schemas.xmlsoap.org/soap/envelope/2004-01-21.xsd

WSDL-Related Documents

Web Services Description Language (WSDL) specifications:

http://www.w3.org/TR/wsdl

UDDI-Related Documents

Universal Description, Discovery and Integration specifications:

http://www.uddi.org/

Encryption-Related Documents

- Key Transport algorithms:
  - RSA-1_5:

    `http://www.w3.org/2001/04/xmlenc#rsa-1_5`
  - RSA-OAEP-MGF1P:

    `http://www.w3.org/2001/04/xmlenc#rsa-oaep-mgf1p`
- Signature keys:
  - RSA-SHA1:

    `http://www.w3.org/2000/09/xmldsig#rsa-sha1`
  - RSA-MD5:

    `http://www.w3.org/2001/04/xmldsig-more#rsa-md5`
  - HMAC-SHA1:

    `http://www.w3.org/2000/09/xmldsig#hmac-sha1`
  - DSA-SHA1:

    `http://www.w3.org/2000/09/xmldsig#dsa-sha1`

Conventions

The following text conventions are used in this document:

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

1

Web Services Overview

This chapter provides an overview of Oracle Application Server Web Services for the 10.1.3 release. Chapter 2, "Oracle Application Server Web Services Architecture and Life Cycle", describes the architecture of Oracle Application Server Web Services.

Understanding Web Services

Web services comprise a set of messaging protocols, programming standards, and network registration and discovery facilities. When they are used together, these features enable the publication of business functions to authorized parties over the Internet from any device connected to the Web.

A Web service is a software application identified by a Universal Resource Identifier (URI), whose interfaces and binding are capable of being defined, described, and discovered by XML artifacts. A Web service supports direct interactions with other software applications using XML-based messages and Internet-based products.

A Web service:

- Exposes and describes itself—A Web service defines its functionality and attributes so that other applications can understand it. By providing a Web Service Description Language (WSDL) file, a Web service makes its functionality available to other applications.
- Allows other services to locate it on the Web—A Web service can be registered in a Universal Description, Discover, and Integration (UDDI) Registry so that applications can locate it.
- Can be invoked—Once a Web service has been located and examined, the remote application can invoke the service using an Internet standard protocol.
- A Web service style is either request or response, or one-way, and it can use either synchronous or asynchronous communication. However, the fundamental unit of exchange between a Web service client and a Web service, of either style or type of communication, is a message.

Web services offer a standards-based infrastructure through which any business can do the following:

- Offer appropriate internal business processes as value-added services that can be used by other organizations
- Integrate its internal business processes and dynamically link them with those of its business partners

Web Services Standards

With the current release, Oracle has extended the Web services infrastructure to implement version 1.4 of the Java 2 Enterprise Edition (J2EE) specification for Web services. This section lists the standards that this release of Web services complies with.

- Java 2 Enterprise Edition
- Simple Object Access Protocol 1.1 and 1.2
- Web Service Description Language 1.1
- Web Service-Interoperability Basic Profile 1.1

Java 2 Enterprise Edition

The current release of Web services is compatible with these Java J2EE standards:

- JAX-RPC 1.1—defines client APIs, support for message handlers, and ways to implement service endpoints
- EJB 2.1—defines the EJB API. The standard JAX-RPC 1.1 specifies how to expose an EJB as a Web service endpoint
- SAAJ 1.2—defines how to process SOAP messages with attachments
- Enterprise Web Services 1.1 specification—(also known as JSRs 109 and 921) specifies how to deploy and execute Web services

Simple Object Access Protocol 1.1 and 1.2

The Simple Object Access Protocol (SOAP) is a lightweight, XML-based protocol for exchanging information in a decentralized distributed environment. SOAP supports different styles of information exchange, including Remote Procedure Call style (RPC) and message-oriented exchange. RPC style information exchange allows for synchronous request and response processing, where an endpoint receives a procedure oriented message and replies with a correlated response message. Message-oriented information exchange supports organizations and applications that must exchange business or other styles of documents in which a message is sent but the sender may not expect or wait for an immediate response (asynchronous). Message-oriented information exchange is also called document-style exchange.

SOAP has these features:

- Protocol independence
- Language independence
- Platform and operating system independence
- Support for RPC/Encoded and Document/Literal message formats

- Support for SOAP XML messages incorporating attachments (using the multipart MIME structure)

The current release of Oracle Application Server Web services supports the SOAP 1.2 protocol and is backward compatible with SOAP 1.1.

See also `http://www.w3.org/TR/SOAP` for more detailed information on the SOAP 1.1 and 1.2 specifications.

Web Service Description Language 1.1

Web Services Description Language (WSDL) is an XML format for describing network services containing RPC-oriented and message-oriented information. Programmers or automated development tools can create WSDL files to describe a service and can make this description available over the Internet. Client-side programmers and development tools can use published WSDL descriptions to obtain information about available Web services and to build and create client proxies or program templates that access available services.

See also `http://www.w3.org/TR/wsdl` for information on the WSDL format.

Web Service-Interoperability Basic Profile 1.1

Web Service-Interoperability (WS-I) is an organization that promotes Web services interoperability across platforms, applications, and programming languages. The current release conforms to the WS-I Basic Profile 1.1.

New and Enhanced Features

In addition to the preceding standards, the current release of OracleAS Web Services contains these new and enhanced features:

- Web Service Security for Authentication, Integrity, and Confidentiality
- Web Services Management Framework and Application Server Control
- Web Services Metadata for the Java Platform (J2SE 5.0 Web Service Annotations)
- REST Web Services
- Enhanced Web Service Home Page for Testing
- Ant Tasks for Configuration and Scripting
- Custom Type Mapping Framework for Serialization
- Database Web Services
- SOAP Header Support
- MIME and DIME Document Support
- Message Delivery Quality of Service
- JMS Transport as an Alternative to HTTP
- Web Services Provider Support
- Web Services Invocation Framework for Describing WSDL Programming Artifacts
- SOAP Message Auditing and Logging
- Oracle BPEL

Web Service Security for Authentication, Integrity, and Confidentiality

The WS-Security standard, published and maintained by the Organization of the Advancement of Structure Information Standards (OASIS), provides profiles for Web services authentication, message encryption, and digital signatures. The current release provides an implementation of WS-Security with the following capabilities:

- XML Signature
- XML Encryption
- Username Token
- X.509 Token
- SAML Token

For more information on Web service security, see the *Oracle Application Server Web Services Security Guide*.

Web Services Management Framework and Application Server Control

The management framework provides configuration and monitoring capabilities for security, reliability, logging, and auditing through the Web-based Application Server Control. These features are exposed through a series of Java Management Extensions (JMX) Management beans (Mbeans).

For more information on Web services management, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*. For more information on the Web service features that you can control through MBeans, see "Web Service MBeans" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Web Services Metadata for the Java Platform (J2SE 5.0 Web Service Annotations)

The current release provides support for J2SE 5.0 Web Service annotations (also known as the Web Services Metadata for the Java Platform (JSR-181) specification). The specification defines an annotated Java syntax for programming Web services. Chapter 10, "Assembling Web Services with Annotations" describes how the annotations are supported and Oracle extensions to the specification.

REST Web Services

The current release provides support for Representational State Transfer (REST) services. This architecture leverages the architectural principles of the Web. It uses the semantics of HTTP whenever possible.

Unlike SOAP Web Services, REST is a "style" and has no standards or tools support from vendors. Also, REST Web services use XML documents, not SOAP envelopes, for sending messages.

You can assemble REST Web services with the WebServicesAssembler tool or by adding J2SE 5.0 Web Service annotations to your source files. You can then use the Web Service Home Page to see if they deployed successfully and to test their functionality. Chapter 11, "Assembling REST Web Services" provides more information on assembling REST Web services.

Enhanced Web Service Home Page for Testing

The functionality of the Web Service Home Page has been expanded beyond testing whether the Web Service deployed correctly. The Home Page lets you input parameter values to the operations you want to test. You can display and edit the SOAP request that will be sent to the service. It also displays the response returned by the service. If your Web service defines security and reliability features, then editors in the Home Page allow you to test the service with different security and reliability values.

The Home page also enables you to test Web Service Providers and REST Web Services. For a REST Web service, the Home Page provides the same functionality as for JAX-RPC Web Services however, it also lets you generate and view the REST POST request and invoke the REST GET URL.

Chapter 12, "Testing Web Service Deployment" provides more information on how to use the Web Service Home Page.

Ant Tasks for Configuration and Scripting

The current release provides Ant tasks for Web services development, with a focus on enabling the scripting and automation of Web service client and server development. Sample Ant tasks are provided throughout this manual. Many of the details for setting up Ant are described in "Setting Up Ant for WebServicesAssembler" on page 3-3. Examples of how to write Ant tasks for Web service assembly commands are presented in Chapter 17, "Using WebServicesAssembler".

Custom Type Mapping Framework for Serialization

Web services in complex systems are often required to map data types beyond the native types automatically serialized into XML by the Web services runtime. The current release offers a custom type-mapping framework for mapping custom data types.

For more information on working with nonstandard data types in your Web service, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Database Web Services

The current release continues to support publishing PL/SQL as a Web service and using OracleAS Web Services as the Java runtime in the Oracle Database 10*g* for call-outs to Web services.

The current release extends the runtime and tool support to declaratively define the following database artifacts as Web services:

- PL/SQL stored procedures
- SQL queries
- DML statements
- Java classes loaded within the database virtual Java machine
- Oracle Streams AQ (Advanced Queues)

For more information on implementing database artifacts as a Web service, see Chapter 9, "Developing Database Web Services".

SOAP Header Support

The current release facilitates advanced manipulation of SOAP headers using two JAX-RPC-compliant mechanisms:

- A mechanism to programmatically intercept SOAP headers using JAX-RPC handlers. This mechanism allows processing SOAP headers out-of-band from the processing of the main SOAP message.
- A mechanism to automatically map SOAP headers to member variables in Java classes. This mechanism enables you to treat SOAP headers as variables in the Web service implementation through a declarative mapping process instead of a programmatic process.

For more information on SOAP headers, see Chapter 15, "Understanding JAX-RPC Handlers". For more information on processing SOAP headers, see Chapter 16, "Processing SOAP Headers".

MIME and DIME Document Support

To facilitate efficient transfer of binary documents and large XML documents, the current release supports MIME and DIME attachments:

- Multipurpose Internet Mail Extensions (MIME) attachments conform to the WS-I Attachment Profile for both WSDL to Java consumption, and Java to WSDL publication of Web services requiring SOAP with MIME attachments.
- Direct Internet Message Encapsulation (DIME) attachments conforming to the Microsoft Corporation analog to MIME. Oracle offers DIME support for backward compatibility with other implementations, because Microsoft no longer encourages DIME for attachments.

For more information on how OracleAS Web Services supports MIME and DIME attachments, see "Working with Message Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Message Delivery Quality of Service

The current release provides an OASIS Web Service Reliability (WS-Reliability) implementation with guaranteed at-least-once message delivery, duplicate message elimination (at most once delivery), exactly once message delivery (guaranteed delivery and duplicate elimination), and message ordering within groups of messages.

For more information on reliability, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

JMS Transport as an Alternative to HTTP

As an alternative to HTTP, the current release enables the use of JMS queues as a transport for SOAP messages. JMS provides a higher level of reliable message delivery for SOAP messages.

Where HTTP is required as the transport, the current release continues to support the ability to put and get SOAP messages from JMS queues and topics, and adds the functionality of correlating messages processed in this manner.

For more information on using JMS to develop Web services, see Chapter 8, "Assembling Web Services with JMS Destinations".

For more information on using JMS as a transport mechanism for Web services, see "Using JMS as a Web Service Transport" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Web Services Provider Support

The Provider API lets you define custom processing logic for a Web services endpoint that is not tied to any particular service endpoint implementation strategy, such as JAX-RPC. The Provider model can be used to provide common functionality to a number of endpoints. Rather than incorporating the same functions into many Web services, the Provider model enables you to add the logic into the runtime directly

For more information on Web service providers, see "Using Web Service Providers" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Web Services Invocation Framework for Describing WSDL Programming Artifacts

The Web Services Invocation Framework (WSIF) provides a general purpose, extensible mechanism to describe programmatic artifacts using WSDL and a framework to invoke those artifacts using their native protocols. The current release supports an initial implementation of WSIF.

For more information on WSIF, see "Using Web Services Invocation Framework" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

SOAP Message Auditing and Logging

The current release provides the ability to record inbound and outbound SOAP messages into logging and auditing files. Entire messages or parts of messages can be logged by subquerying through the use of Xpath statements.

For more information on logging and auditing messages, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Oracle BPEL

BPEL (Business Process Execution Language) is a standard published by the Organization of the Advancement of Structure Information Standards (OASIS) and backed by major vendors including Oracle. BPEL describes an XML syntax for describing a business process through a "composition of invocations of (other) Business Processes—typically Web services". A BPEL process definition, therefore, is an XML document composed according to an XSD that is maintained by OASIS.

A business process, in BPEL terms, is composed of invocations (call-outs to Web services), receptions (call-ins from external services), decision points with simple conditional logic and parallel flows or sequences, that in turn consist of invocations, decision points, and so on. Variables can be defined as part of a business process. They can be assigned values from parameters passed to the business process at startup, passed along in invocations, given values from the results of invocations, and returned as the final result of the business process. A business process itself is also implemented as a Web service—in the BPEL (runtime) engine.

The Oracle implementation of BPEL uses WSIF technology to directly invoke business processes. In certain cases, the actual invocation from BPEL can be a direct call to a Java class without the Web service overhead of marshalling and unmarshalling SOAP messages.

For more information on Oracle BPEL, see the following Web site:

http://www.oracle.com/technology/products/ias/bpel/index.html

Compatibility with Previous Versions of Web Services

Applications designed to run with versions 9.0.4 or 10.1.2 of the Oracle Application Server can be used with version 10.1.3. While you can still deploy your 9.0.4 or 10.1.2 Web Services in the 10.1.3 Application Server, you will not be able to see them in the management console.

Redeploying Applications on OracleAS Web Services 10.1.3

For backward compatibility, Oracle Application Server 10*g* Release 3 (10.1.3) includes the underlying software required to run 10*g* Release 2 (10.1.2) Web services. As a result, Web services applications designed to run with Oracle Application Server 10*g* (9.0.4) and 10*g* Release 2 (10.1.2) can be used without modification with Release 3.

However, there are significant advantages to recreating your Web services for 10*g* Release 3 (10.1.3). For example, you can take advantage of the all the new features such as quality of service (QOS), a standard-based development model (JAX-RPC), and JMX-based management.

Oracle Application Server Upgrade and Compatibility Guide provides more information on redeploying your existing Web service applications to OracleAS Web Services 10.1.3.

Deprecated Features

The version 10.1.2 Web services stack is being deprecated, however, it is still supported in version 10.1.3.

The `ws.debug` system property and its related behavior has been deprecated.

Clustered Environments and High Availability

To use OracleAS Web Services in a clustered environment, you must install the service on every machine in the cluster. Application Server Control enables you to easily deploy a service to a group of instances within an Oracle Application Server cluster. For more information on deploying to a group of instances, see "Deploying to OC4J Instances Within a Cluster" in the *Oracle Containers for J2EE Deployment Guide*.

If you install a standard, stateless Web service, then a clustered deployment will result in multiple instances that can process requests, but cannot share state.

If you install a stateful Web service, then those instances will share state. If the service is not installed on all machines in a cluster, then the cluster dispatcher might dispatch a service request to a machine that does not have the service, resulting in an error on the service invocation.

To support a clustered environment, for stateful Java Web services with serializable Java classes, the WebServicesAssembler adds a `<distributable>` tag in the `web.xml` of the Web service[1]s generated J2EE EAR file.

OC4J in a Standalone Versus Oracle Application Server Environment

During development, it is typical to use OC4J by itself, outside an OracleAS Web Services environment. We refer to this as standalone OC4J (or, sometimes, as unmanaged OC4J). In this scenario, OC4J can use its own Web listener and is not managed by any external Oracle Application Server processes.

In contrast, a full Oracle Application Server environment (sometimes referred to as managed OC4J), includes the use of Oracle HTTP Server as the Web listener, and the Oracle Process Manager and Notification Server (OPMN) to manage the environment.

See the *Oracle Containers for J2EE Configuration and Administration Guide* for additional information about Oracle Application Server versus standalone environments and about the use of Oracle HTTP Server and OPMN with OC4J.

See the *Oracle HTTP Server Administrator's Guide* for general information about the Oracle HTTP Server and the related `mod_oc4j` module. (Connection to the OC4J servlet container from Oracle HTTP Server is through this module.)

See the *Oracle Process Manager and Notification Server Administrator's Guide* for general information about OPMN.

2

Oracle Application Server Web Services Architecture and Life Cycle

This chapter provides an overview of the components that comprise Oracle Application Server Web Services and publishable service artifacts. These components are defined by the Java API for XML-Based RPC (JAX-RPC). This API enables Java technology developers to build Web applications and Web services incorporating XML-based RPC functionality according to the SOAP (Simple Object Access Protocol) 1.1 specification.

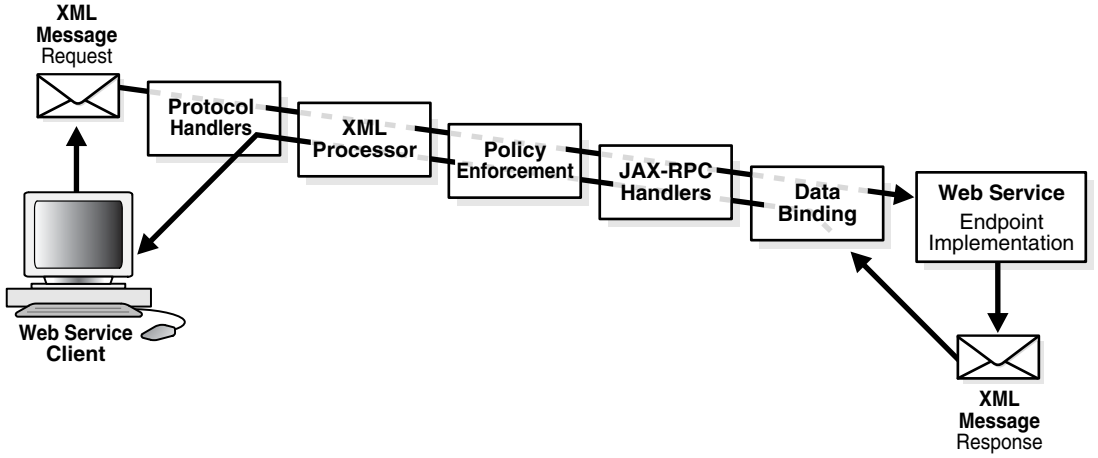
Architecture

The OracleAS Web Services stack is designed with three primary goals in mind: performance, interoperability, and manageability. This section describes how the Web services runtime is structured to provide enterprise-quality infrastructure for SOAP-based communication endpoints.

Processing Components

Each step in the processing of a Web services request is represented by a logical component in the runtime infrastructure. As an XML message is delivered to the system, it flows through the following layers before being delivered to an endpoint implementation: protocol handlers, XML processor, policy enforcement pipeline, JAX-RPC handlers, data binding, and the endpoint implementation. Response messages flow through the same infrastructure following a reverse path.

Figure 2–1 How XML Messages Flow From Client to Service



This section describes the purpose of each of these processing layers. Where appropriate, pointers to other sections are provided for more detailed information on system functionality and configuration.

Protocol Handlers

A protocol handler provides the entry point to the Web services infrastructure. The protocol handler is used to send and receive SOAP messages over a transport protocol. The Web services infrastructure can be configured to send and receive messages over HTTP or JMS.

If the messages are sent over HTTP, the OracleAS Web Services stack uses the Oracle HTTP Client libraries for sending Web services messages to services and the OC4J Servlet engine for receiving Web services messages sent by clients. All of the capabilities and management infrastructure of the Oracle servlet environment are available to Web services. For example, a Web service can be accessed with an encrypted data stream using HTTP or HTTPS.

JMS transport may be configured to work with different JMS providers. It is integrated into the application server by using the JMS infrastructure provided with the Oracle Application Server. JMS is often used to gain the full quality of service features of a message bus during a SOAP message exchange.

XML Processing

Once the SOAP message is retrieved from the transport layer, it is converted into an XML message representation that is compatible with the SOAP with Attachments API for Java (SAAJ). The SAAJ message is constructed using Oracle's optimized XML parsing technologies for performance and efficient memory utilization. This message is the basis for the JAX-RPC compliant SOAP processing infrastructure provided with OC4J. Once instantiated, the SAAJ message is delivered to the next layer of the processing stack.

Some portions of the SOAP request may not be XML. For example, a SOAP message may be sent with attachments, which are used to package non-XML content along with a SOAP message. The SAAJ implementation also deals with these attachments.

Though the default processing of XML messages assumes the message payload is encoded in a SOAP 1.1 or SOAP 1.2 compliant envelope, the OracleAS Web Services stack can also be configured to accept and dispatch XML messages over HTTP directly without using SOAP. This allows developers to create applications that integrate directly with existing HTTP infrastructure that is not aware of the SOAP protocol. Applications can be built to conform to the REST architecture style, using HTTP and URLs to define the messages that describe the system.

When configured to use XML-over-HTTP messaging, the infrastructure determines if a message contains an application message directly or a SOAP envelope as the top level element of the payload. If the message is "raw" XML, the processing layer will wrap the message in a SOAP envelope with no headers. This SOAP envelope can then be processed through the rest of the Web services processing elements and delivered to the endpoint implementation for processing.

The XML message is next processed by the policy enforcement mechanisms of the Web services stack.

Policy Enforcement

The OracleAS Web Services stack can be configured with additional information to enable a management chain that is responsible for enforcing runtime management policies. These policies include Web services management features like WS-Reliability,

WS-Security, auditing, and logging capabilities."Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on the setup of these features. The *Oracle Application Server Web Services Security Guide* provides more information on setting up security. Enabled policies can be included in the WSDL document associated with a service to support automated configuration of client interceptor pipelines.

One of the protocols that the OracleAS Web Services stack supports is the WS-Reliability standard, which provides delivery guarantees for SOAP messages. The reliability infrastructure supports additional capabilities that allow the system infrastructure to send and receive asynchronous acknowledgment messages that conform to the WS-Reliability protocol. This is supported as an extension to the Oracle client infrastructure, which is available when using a JAX-RPC Stub or Call object.

The interceptor chain can also be configured to delegate to the OracleAS Web Services Management agent pipeline. This provides pre-integrated support for OracleAS Web Services Management product and capabilities that support management of policies for Web services across a data center.

The management interceptors provide a runtime infrastructure for systems services that are provided in OC4J. Application-specific interceptors are supported in conformance with the JAX-RPC 1.1 Handler API.

JAX-RPC Handlers

Handlers are configured to process application-specific SOAP headers according to specific roles or actor attributes. The handlers have access to a SAAJ representation of the SOAP message and can perform operations on any level of the SOAP message. Use of the Handler API is described in Chapter 15, "Understanding JAX-RPC Handlers" and Chapter 16, "Processing SOAP Headers".

Together, the interceptors and the handlers are used to enforce the SOAP processing model. This allows Web services endpoints to selectively process SOAP headers that are intended for a particular node. SOAP messages can then be passed along to other nodes in the system and SOAP headers are processed as required.

Data Binding

In many applications, portions of the XML payload are converted to Java objects that are used by the application framework. This capability is often called data binding, where portions of XML data are bound to members of a Java class hierarchy. The process of data binding is driven through the serialization framework, which manages the conversion from XML to Java. The serialization framework is extensible and allows developers to define custom type mapping from XML data to Java objects.

The OC4J runtime features a special "provider" implementation that is optimized for processing SAAJ messages. When the provider is used, no data binding is performed. Providers can be used to implement applications that work directly with XML payload in a SOAP message.

Endpoint Implementation

After passing through the preceding four layers of the Web services stack, the endpoint implementation containing the application business logic is invoked. The endpoint can be a regular Java class, an Enterprise Java Bean, or a provider. The endpoint can also be a JMS queue when a JMS endpoint configuration is enabled.

In the OracleAS Web Services container, there are very few requirements that a Java class must conform to in order to be exposed as a Web service. If the endpoint implementation requires more complex interaction with the container throughout its

life cycle, it can implement a JAX-RPC `ServiceLifecycle` interface, which provides more information about the Web services requests to the endpoint during initialization of the service and while handling requests.

Java classes may also be augmented with Web services specific annotations. These annotations can be used to provide additional configuration information specifying what methods are exposed as Web services operations, what protocols can be used to access the service, and so on. Chapter 10, "Assembling Web Services with Annotations" provides more information about OracleAS Web Services support for J2SE 5.0 JDK Web Service Annotations.

Java Management Extensions (JMX)

While the interceptor pipeline is used to enforce management policies, systems management capabilities are exposed in the OracleAS Web Services stack by using the Java Management Extensions (JMX) standard. JMX allows administrators to gather important metrics on the health of a running OC4J system and to change the configuration of a running system. JMX metrics and operations are available in the Web services console in the Application Server Control tool.

Development Tools

Another key feature of the OracleAS Web Services implementation is the development tools that allow for the development and deployment of endpoint implementations. Web services can be developed using either command line tools or a Java Integrated Development Environment (IDE).

WebServicesAssembler (WSA), the command line tool, is used to generate artifacts required to deploy a Web service from WSDL or endpoint implementation classes. It is useful for automating the creation of Web services in a scripted environment since, in addition to command line, it exposes its functionality as Ant tasks.

JDeveloper, Oracle's full-featured Java IDE, can be used for end-to-end development of Web services. Developers can build Java classes or EJBs, expose them as Web services, automatically deploy them to an instance of the Oracle Application Server, and immediately test the running Web service. Alternatively, JDeveloper can be used to drive the creation of Web services from WSDL descriptions. Like WebServicesAssembler, JDeveloper also is Ant-aware. You can use this tool to build and run Ant scripts for assembling the client and for assembling and deploying the service.

Web Services Development Life Cycle

This section describes the stages of Web service development.

1. Create the Implementation
2. Generate the Web Service
3. Generate the Client
4. Deploy the Web Service
5. Test the Web Service
6. Perform Post Deployment Tasks

Create the Implementation

Create the implementation that you want to expose as a Web service. OracleAS Web Services allows a variety of artifacts to be exposed as a Web service, including:

- Java classes
- Enterprise Java Beans (EJBs)
- JMS queues or topics
- PL/SQL procedures
- SQL Statements
- Oracle Advanced Queues
- Java classes in the database
- CORBA servant objects

You can develop these artifacts using any tool or IDE. Oracle JDeveloper enables you to create Java classes, JMS queues and topics, PL/SQL procedures, CORBA servant objects, and EJBs.

Generate the Web Service

OracleAS Web Services provides a variety of commands that let you generate a Web service by using either a top down (starting with a WSDL) or a bottom up (starting with Java classes, EJBs, database artifacts, or JMS queues) approach. These commands are described in "Web Service Assembly Commands" on page 17-3. These commands can be issued on the command line or they can be written as tasks in an Ant script.

Since JDeveloper is fully Ant-aware, you can use this tool to build and run the Ant scripts. JDeveloper also has design-time wizards which symmetrically mirror several of the Web service generation commands. Using these wizards can speed your development process and save you the steps of creating the build scripts.

Most current Java IDEs (such as Eclipse) are also Ant-aware. You can use any of these IDEs to run the Ant scripts if you choose not to use JDeveloper.

If you need to invoke other OracleAS Web Services commands, for example, to generate a WSDL or to add quality of service features, you can invoke them on the command line or with Ant tasks. While there are no design-time wizards to support these commands, the Ant tasks can be run directly in JDeveloper.

Generate the Client

OracleAS Web Services provides commands that can be used to generate J2SE and J2EE client code.

Oracle JDeveloper supports OC4J J2SE Web service clients by allowing developers to create Java stubs from Web service WSDL descriptions. These stubs can then be used to access existing Web services.

Deploy the Web Service

Web services deployment can be performed either with Java-language commands or with Ant tasks. The Ant tasks can reside in a build file or they can be issued directly from JDeveloper. JDeveloper also has a deployment wizard which configures the deployable EAR file and deploys it.

Deployment can also be performed with Application Server Control. However, this tool cannot be used to configure the EAR file or change its contents.

Test the Web Service

The OracleAS Web Services stack provides a Web Service Home Page for each deployed Web service. By entering a service endpoint address in a Web browser, you can access the operations that the Web service exposes. Interactive pages let you invoke the operations for values that you enter.

The WebServicesAssembler command line tool can generate tests suitable for the JUnit framework for every method in the Web service. If you use the WebServicesAssembler tool to generate JUnit tests for the `assemble`, `plsqlAssemble`, and `genProxy` commands, then JDeveloper can import them by default.

Perform Post Deployment Tasks

There are a number of tasks you can perform post-deployment. Some of these involve fine-tuning the performance of the Web service, such as changing security and logging policies. Others involve larger changes to the Web service, such as changing a key store configuration. You can make some of these changes dynamically; for others, you must redeploy the Web service. To perform these tasks, use Oracle Application Server Control. For more information on these tasks, see the Application Server Control on-line help.

3

Getting Started

The `README.txt` file that is included at the top level of the OC4J distribution provides instructions for setting up and running OC4J. This chapter serves as an addendum to the `README`. It provides information that is specific to setting up Oracle Application Server Web Services in your environment.

This chapter provides the following sections.

Supported Platforms

OracleAS Web Services is supported on the following platforms.

- Redhat Linux
- Solaris Sparc 32- and 64-bit
- Microsoft Windows: Windows XP, Windows 2000, Windows Server 2003

Installing OC4J

Follow the instructions in the `README.txt` file for installing and running OC4J. The `README.txt` file can be found at the top-level of the OC4J distribution.

Setting Up Your Environment for OracleAS Web Services

This section lists the software you must install and environment variables you must define to use OracleAS Web Services.

- Java2 Standard Edition (J2SE) JDK version 1.4.1 or later
- Java2 Standard Edition (J2SE) JDK version 5.0 or later, if you are using the JDK 5.0 Web Service Annotations feature
- Jakarta Ant 1.5.x or 1.6.x (recommended) is required if you will be using Ant tasks to assemble Web services. Jakarta Ant 1.6.x is included in the OracleAS Web Services distribution.

  - If you want to have your own installation, you can obtain Ant from the following Web address.

    `http://jakarta.apache.org/ant/index.html`

  - If you are using your own installation of Ant, see "Setting Up Ant for WebServicesAssembler" on page 3-3 for instructions on setting up Ant to assemble Web services.

  - If you installed the version of Ant that is distributed with Oracle Application Server, then Ant tasks for OracleAS Web Services will already be configured. Follow the instructions under "Setting Up Ant 1.6.2 Distributed with Oracle Application Server" to appropriately modify your environment and build files.

- Define the following environment variables:

  - *ORACLE_HOME*—define this variable to point to the OC4J installation directory.

  - *JAVA_HOME*—define this variable to point to the J2SE SDK installation directory.

- Add the following files or paths to the classpath:

  - OracleAS Web Services expects *JAVA_HOME*`/bin/java` to point to the Java VM and *JAVA_HOME*`/bin/javac` to point to the Java compiler executables.

  - To make assembly of Web services and the processing of XML files more convenient, add the paths to the WebServicesAssembler JAR, *ORACLE_HOME*`/webservices/lib/wsa.jar`, and the XML parser JAR, *ORACLE_HOME*`/lib/xmlparserv2.jar`, to the classpath.

  - If you want to assemble and compile your Web Services programs using Ant, appropriate `CLASSPATH` settings can be found in the Ant scripts accompanying the Web Services example code. If you want to invoke the WebServicesAssembler and compile generated code on the command line, you may want to add the full complement of libraries to your `CLASSPATH`. "Sample Classpath Commands" on page A-6 provides a sample Windows platform `set CLASSPATH` command for all of the OracleAS Web Services client JAR files. The classpath on the UNIX platform would be set in a similar manner.

  - OracleAS Web Services provides a separate library, `wsclient_extended.jar`, for running Web services clients in a J2SE environment. This library includes everything that would be required by OracleAS Web Services clients in a J2SE environment and should simplify the packaging and distribution of your J2SE client applications. You can find the `wsclient_extended.jar` file at the following address on the Oracle Technology Network Web site.

    `http://download.oracle.com/otn/java/oc4j/1013/wsclient_extended.zip`

    If you installed the OC4J companion CD, then the `wsclient_extended.jar` file can also be found in the *ORACLE_HOME*`/webservices/lib` directory.

    "Simplifying the Classpath with wsclient_extended.jar" on page A-2 provides more information on `wsclient_extended.jar` file.

- If you will be enabling reliable messaging between the client and server, you must run SQL scripts that will install tables for both the client and server. "Installing SQL Tables for the Client and Server" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on how to find and run the SQL scripts.

- You will need an installed, running Oracle database if you are using reliable messaging or assembling database Web services. For more information, see "Database Requirements" on page 3-6.

Setting Up Ant for WebServicesAssembler

The WebServicesAssembler tool assists in assembling OracleAS Web Services. It enables you to generate the artifacts required to develop and deploy Web services, regardless of whether you are creating the service using the top down or bottom up approach. WebServicesAssembler commands can be called either from the command line or from Ant tasks.

This section describes how to set up your environment and build script files to call WebServicesAssembler commands from Ant tasks.You can use an Ant installation you have previously installed or use the Ant that is found in *OC4J_HOME*/ant. The following sections describe how to set up Ant, depending on the version you have installed.

Note: All of the Ant task examples in this book assume that you are using Ant version 1.6.2 or later. These versions let you use task namespaces. Hence, all of the Ant tags and subtags corresponding to WebServicesAssembler commands are prefixed with the `oracle:` namespace.

- Setting Up Ant 1.6.2 Distributed with Oracle Application Server
- Setting Up Ant 1.6.2 Using a Previous Installation of Ant
- Setting Up Ant 1.5.2 Using a Previous Installation of Ant
- Using the "oracle:" namespace Prefix for Ant Tasks

Setting Up Ant 1.6.2 Distributed with Oracle Application Server

The following steps describe how to set up your environment and build files to use WebServicesAssembler with the Ant 1.6.2 installation found in *ORACLE_HOME*/ant. This is the version of Ant distributed with the Oracle Application Server.

1. Enter *ORACLE_HOME*/ant/bin at the front of your PATH variable.
2. Edit your build script (build.xml). Add the antlib:oracle namespace declaration for the imported Ant tasks. In the following example, *bottomup* is the name of your project.

   ```
   <project name="bottomup" default="all" basedir="."
   xmlns:oracle="antlib:oracle">
   ```

3. Add the oracle: namespace as a prefix to all WebServicesAssembler tags. For example:

   ```
   <oracle:assemble ....>
           <oracle:port ... />
   </oracle:assemble>
   <oracle:genProxy ..../>
   ```

4. (Optional) Copy the ant-oracle.properties files to the same directory as your build script.

Although you can modify the properties file in the `j2ee/utilities` directory and reference it from your build scripts, it is better to maintain this file as a template.

5. (Optional) Edit the `ant-oracle.properties` file to reflect your installation environment.
6. (Optional) Edit the build script (`build.xml`). Reference the `ant-oracle.properties` file in the build script. For example:

```
<property file="ant-oracle.properties"/>
```

7. (Optional) If you will be using the `junit` Ant task for reports, set the `ANT_OPTS` system property to the Xalan `TransformerFactoryImpl` class.
   - If you are using the JDK 1.5, set the `ANT_OPTS` property for `TransformerFactory` to `com.sun.org.apache.xalan.int/ernal.xsltc.trax.TransformerFactoryImpl`. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=com.sun.org.apache.xalan.int/
ernal.xsltc.trax.TransformerFactoryImpl
```

   - If you are using the JDK 1.4, set the `ANT_OPTS` property for `TransformerFactory` to `org.apache.xalan.processor.TransformerFactoryImpl`. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=org.apache.xalan.processor.Tr
ansformerFactoryImpl
```

Setting Up Ant 1.6.2 Using a Previous Installation of Ant

The following steps describe how to set up your environment and build files to use WebServicesAssembler with a previous installation of Ant 1.6.2 (or later).

1. Navigate to the directory *`ORACLE_HOME`*`/j2ee/utilities` and ensure that the following files are present:
   - `ant-oracle.properties`—this file enables you to designate the key properties for the execution of the Oracle Ant tasks.
   - `ant-oracle.xml`—this file enables you to use Oracle Ant tasks. Import this file into your build script by using the Ant `<import>` task.
2. Copy the `ant-oracle.properties` and `ant-oracle.xml` files to the same directory as your build script (`build.xml`).

   Although you can modify the files in the `j2ee/utilities` directory and reference them from your build scripts, it is better to maintain the source files as templates. Also, if you leave the `ant-oracle.xml` file in its original location, then the import reference must be hard coded to specify the full path to the file (for example, `c:/oc4j/j2ee/utilities/ant-oracle.xml`).
3. Edit the `ant-oracle.properties` file to reflect your installation environment.
4. Edit the build script (`build.xml`).
   - Import the `ant-oracle.xml` file into the build script.

```
<!-- Import for OC4J ant integration. -->
<import file="ant-oracle.xml"/>
```

- Add the `antlib:oracle` namespace reference for the imported Ant tasks. In the following example, *bottomup* is the name of your project.

```
<project name="bottomup" default="all" basedir="."
xmlns:oracle="antlib:oracle">
```

5. Include the `oracle` namespace as a prefix to all WebServicesAssembler commands. For example:

```
<oracle:deploy ..../>
<oracle:genProxy ..../>
```

6. (Optional) If you will be using the `junit` Ant task for reports, set the `ANT_OPTS` system property to the Xalan `TransformerFactoryImpl` class.

   - If you are using the JDK 1.5, set the `ANT_OPTS` property for `TransformerFactory` to `com.sun.org.apache.xalan.int/ernal.xsltc.trax.TransformerFactoryImpl`. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=com.sun.org.apache.xalan.int/
ernal.xsltc.trax.TransformerFactoryImpl
```

   - If you are using the JDK 1.4, set the `ANT_OPTS` property for `TransformerFactory` to `org.apache.xalan.processor.TransformerFactoryImpl`. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=org.apache.xalan.processor.Tr
ansformerFactoryImpl
```

Setting Up Ant 1.5.2 Using a Previous Installation of Ant

The following steps describe how to set up your environment and build files to use WebServicesAssembler with a previous installation of Ant 1.5.2.

1. Ensure that your installations of Ant and the Java JDK are already included in the classpath environment variable.
2. Add the path to the `wsa.jar` to the classpath environment variable. The path will typically be:

```
(OC4J_Home)webservices/lib/wsa.jar
```

   In this example, *OC4J_Home* is the directory where you installed OC4J.

3. Add the following lines to any Ant build file that will invoke the Ant tasks.

```
<taskdef resource="orawsa.tasks" />
<typedef resource="orawsa.types" />
```

   These lines can appear anywhere in the build file before the first WebServicesAssembler task is called.

4. (Optional) If you will be using the `junit` Ant task for reports, set the `ANT_OPTS` system property to the Xalan `TransformerFactoryImpl` class.

   - If you are using the JDK 1.5, set the `ANT_OPTS` property for `TransformerFactory` to

com.sun.org.apache.xalan.int/ernal.xsltc.trax.TransformerFactoryImpl. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=com.sun.org.apache.xalan.int/
ernal.xsltc.trax.TransformerFactoryImpl
```

- If you are using the JDK 1.4, set the ANT_OPTS property for TransformerFactory to org.apache.xalan.processor.TransformerFactoryImpl. For example:

```
set ANT_
OPTS=-Djavax.xml.transform.TransformerFactory=org.apache.xalan.processor.Tr
ansformerFactoryImpl
```

Using the "oracle:" namespace Prefix for Ant Tasks

Ant version 1.6.2 and higher requires the oracle: prefix at the beginning of all Ant tags and subtags for WebServicesAssembler commands. This prefix informs the Ant interpreter that this is an Oracle Ant task.

The oracle: prefix corresponds to the prefix that is found in the project tag at the beginning of the Ant build.xml file.

```
<project name="myproject" default="all" basedir="." xmlns:oracle="antlib:oracle">
```

If you do not want to use oracle as a prefix, you can change it to any valid XML QName prefix. For example, if you want to use oracletags as a prefix, then you must change the value of the project tag.

```
<project name="myproject" default="all" basedir="."
xmlns:oracletags="antlib:oracle">
```

If you make this change, then all Ant tags and subtags for WebServicesAssembler commands must start with oracletags:. For example:

```
<oracletags:assemble ...>
```

Database Requirements

You will need an installed running Oracle database (local or remote) if you will be performing any of the following tasks:

- assembling any of the database Web Services. Chapter 9, "Developing Database Web Services" provides more information on the database Web services that can be run on OracleAS Web Services.
- enabling reliable messaging between the client and server. "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on reliable messaging.

Development and Documentation Roadmap

The following sections provide a suggested roadmap through the documentation that takes you through the steps of developing a Web service.

- Setting Up Your Environment
- Best Coding Practices

- Assembling Web Service Artifacts
- Deploying the Web Service
- Testing the Deployed Web Service
- Assembling a Web Service Client
- Adding Quality of Service Features to a Web Service
- Adding Advanced Functionality to a Web Service
- Alternative Web Service Strategies
- Reference Chapters and Appendixes

Setting Up Your Environment

The following chapter describes how to set up your environment to use the functionality provided by OracleAS Web Services.

- Chapter 3, "Getting Started"

Best Coding Practices

The chapters in this section describe issues that you should consider as you design your Web service.

The following chapter describes the varieties of message formats that you can employ in OracleAS Web Services. It describes the advantages and disadvantages of each message format and suggests which format to use based on the client functionality.

- Chapter 4, "Oracle Application Server Web Services Messages"

The following chapter in the *Oracle Application Server Advanced Web Services Developer's Guide* identifies some of the common areas where interoperability problems can occur. It provides design suggestions and programming guidelines that increase the interoperability of your Web service with applications on different platforms.

- "Ensuring Interoperable Web Services"

Assembling Web Service Artifacts

OracleAS Web Services enables you to assemble Web service artifacts bottom up starting from Java classes, EJBs, JMS destinations, database resources, or source files which employ J2SE 5.0 JDK Web Service Annotations. You can also assemble the artifacts top down starting from a WSDL. In OracleAS Web Services, you use the WebServicesAssembler tool to perform the assembly. Chapter 17, "Using WebServicesAssembler" provides a reference guide to the tool.

The following chapters describe how to use the WebServicesAssembler tool to perform the different types of Web Service assembly supported by OracleAS Web Services.

- Chapter 5, "Assembling a Web Service from a WSDL"
- Chapter 6, "Assembling a Web Service with Java Classes"
- Chapter 7, "Assembling a Web Service with EJBs"
- Chapter 8, "Assembling Web Services with JMS Destinations"
- Chapter 9, "Developing Database Web Services"
- Chapter 10, "Assembling Web Services with Annotations"

Deploying the Web Service

While the WebServicesAssembler tool does not perform deployment, it does package the Web service into a deployable EAR or WAR file. Deploying this file is very similar to deploying any other EAR or WAR file into a running instance of OC4J. OC4J provides a separate book that describes how to perform deployment.

- *Oracle Containers for J2EE Deployment Guide*

The following chapter provides additional information about the packaging format and the files required for deployment. The chapter also briefly describes the deployment support offered by the JDeveloper and Application Server Control tools.

- Chapter 18, "Packaging and Deploying Web Services"

Testing the Deployed Web Service

The following chapter describes the Web Service Home Page. This page lets you test whether deployment was successful without the need to write any code.

- Chapter 12, "Testing Web Service Deployment"

Assembling a Web Service Client

The following chapters describe how to use WebServicesAssembler to assemble a Web service client for the J2SE and J2EE platforms.

- Chapter 13, "Assembling a J2EE Web Service Client"
- Chapter 14, "Assembling a J2SE Web Service Client"

Adding Quality of Service Features to a Web Service

OracleAS Web Services support quality of service features, such as security, reliability, message logging, and auditing. The following chapters describe how to implement these features; they can be managed by other tools such as JDeveloper and Application Server Control. The following chapters appear in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- "Managing Web Services"
- "Ensuring Web Services Security"

  This chapter provides only an overview of the contents of the *Oracle Application Server Web Services Security Guide*. The Security Guide describes the Web Services implementation of message-level security.
- "Ensuring Web Service Reliability"
- "Auditing and Logging Messages"

Adding Advanced Functionality to a Web Service

The following chapters describe additional features that can enhance the performance and functionality of your Web service.

- Chapter 15, "Understanding JAX-RPC Handlers"
- Chapter 16, "Processing SOAP Headers"

See also the following chapters in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- "Working with Message Attachments"
- "Custom Serialization of Java Value Types"

Alternative Web Service Strategies

The following chapters describe alternative modes of Web service implementation.

For example, you can write your own infrastructure to make Web service calls, create a client for non-SOAP protocols, or use a non-HTTP transport mechanism.

- Chapter 11, "Assembling REST Web Services"

See also the following chapters in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- "Using JMS as a Web Service Transport"
- "Using Web Service Invocation Framework"
- "Using Web Service Providers"

Reference Chapters and Appendixes

The following chapters and appendixes provide information to supplement the implementation and development tasks described in this book.

- Chapter 1, "Web Services Overview"
- Chapter 2, "Oracle Application Server Web Services Architecture and Life Cycle"
- Chapter 17, "Using WebServicesAssembler"
- Appendix A, "Web Service Client APIs and JARs"
- Appendix B, "Oracle Implementation of the WSDL 1.1 API"

See also the following reference chapters and appendixes in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- "Understanding the WSMGMT Schema"
- "JAX-RPC Mapping File Descriptor"
- "Web Service MBeans"
- "Mapping Java Types to XML and WSDL Types"

4

Oracle Application Server Web Services Messages

Oracle Application Server Web Services supports SOAP 1.1 and 1.2 messages. The format of the messages can be document or RPC style and literal or encoded use.

This chapter contains these sections:

OracleAS Web Services Message Formats

This section describes the message formats supported by the current release of OracleAS Web Services. It includes these topics:

To understand the message formats supported by OracleAS Web Services, it is useful to understand the relationship between the Web Service Description Language (WSDL) 1.1 and the wire format. The wire format is the physical representation of a Simple Object Access Protocol (SOAP) message, or payload, for transmission. The message format is determined by the use and style attributes from the binding defined in the WSDL. The type of XML schema that defines the message part enhances the message format. The WSDL, then, can be thought of as a contract. By defining the various attributes in the WSDL, you affect the format of the message on the wire.

Any interoperability issues that arise are usually noticed at runtime in the wire format. Often, you can fix these by adjusting the WSDL and regenerating the Web service artifacts.

The relationship between the message format and the wire format is not one-to-one. For example, you can define a document-literal style Web service, Service A, with an XML schema that makes runtime SOAP messages look identical to messages produced by an RPC-literal style Web service, Service B. If you change the style and use (that is, the message format) of Service A to be "RPC" and "literal", then Service A will not be the same as Service B. The runtime SOAP messages would look completely different after the change, unless you also change the schema used in Service A.

Understanding Message Formats

The following sections briefly describe the message formats supported by OracleAS Web Services. For detailed descriptions of the message format options (that is, the full implications of the `use` and `style` WSDL binding attributes) see the SOAP and WSDL specifications listed in "SOAP-Related Documents" on page xxi and "WSDL-Related Documents" on page xxi.

RPC and Document Styles

A SOAP payload can be either RPC or document style. An RPC-style payload is usually used if there is a need to invoke a remote procedure or method call. With RPC style, the name of the top-most XML element in the SOAP body of the request is always the name of the WSDL operation. There is no ambiguity, because the names are unique in a given binding. The SOAP XML message typically consists of a method name and parameters, all represented in XML.

If the WSDL operation is overloaded, there must be a unique `SOAPAction` specified in the corresponding operation binding. Section 7 of the SOAP 1.1 specification describes the structure of an RPC-style SOAP body element (`<body>`).

The SOAP body of a document-style payload contains XML that does not have to conform to Section 7 of the SOAP 1.1 specification, but it uses an XML schema global element to define the payload of the message. That schema is defined within or imported into the WSDL's `type` section.

Literal and Encoded Uses

The SOAP client and server interprets the XML contents of the SOAP payload `<body>` element according to the rules specified by the `use` attribute of the WSDL's `binding` section. The client and server must agree on the same encoding rule to ensure that they can each correctly interpret the data.

For a literal use, the rules for encoding and interpreting the SOAP body of input and output messages are described entirely in terms of the schema.

For the encoded use, the `encodingStyle` attribute in the SOAP body identifies the rules used for encoding and interpreting the message according to the SOAP specification:

- For SOAP 1.1, see "SOAP Encoding", Section 5 of the SOAP 1.1 specification: `http://www.w3.org/TR/2000/NOTE-SOAP-20000508/#_Toc478383512`
- For SOAP 1.2, see "SOAP Encoding", Section 3 of the SOAP 1.2 specification: `http://www.w3.org/TR/2003/REC-soap12-part2-20030624/#soapenc`

You can also use types defined in the SOAP encoding schema extension.

Supported Message Formats

The following sections describe the message formats supported by OracleAS Web Services.

- Document-Literal Message Format
- RPC-Encoded Message Format
- RPC-Literal Message Format

Document-Literal Message Format

Document-literal is the default message format for OracleAS Web Services. The two common styles of document-literal operations are wrapped and bare.

- For a wrapped style, a schema definition of a wrapper element wraps the parameters belonging to a method. The messages are not SOAP encoded and do not use SOAP RPC conventions.
- For a bare style, the method must have only one parameter mapped to a SOAP body. If the method has multiple parameters, then only one can be mapped to the body part. The other parameters must be mapped to SOAP headers.

Document-literal complies with WS-I Basic Profile 1.0 and 1.1.

Each document-literal operation is uniquely identified from the `QName` of the top element of the input message. Document-literal with the wrapped style has the best interoperability with .NET Web services and is the preferred message format for OracleAS Web Services.

For information on interoperability and message formats see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Advantages:

- Complies with WS-I.
- Provides support for interoperability.
- Natural format for SOAP fault handling.
- Format of the message part is described by the standard XML schema.

Disadvantages:

- Not fully backward compatible with older stacks.
- Does not support object graphs.

Sample Request Message with the Document-Literal Message Format Example 4–1 illustrates a request message in the document-literal message format. Note that the XML element part (`payloadDocument`) under the SOAP body (`env:Body`) must be a document instance of a global element defined in the WSDL's schema.

The example applies to SOAP 1.1 messages. To change the example to apply to SOAP 1.2 messages, change the value of `xmlns:env` to `http://www.w3.org/2003/05/soap-envelope`.

Example 4–1 Request Message with the Document-Literal Message Format

```
<env:Envelope
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ns0="http://ws.oracle.com/doc-lit">
        <env:Body>
                <ns0:payloadDocument>
                        <ns0:name>Scott</ns0:name>
                        <ns0:data>Hello</ns0:data>
                </ns0:payloadDocument>
        </env:Body>
</env:Envelope>
```

RPC-Encoded Message Format

The RPC-encoded message format uses the encoding rules defined in the SOAP specification:

- For SOAP 1.1, see "SOAP Encoding", Section 5 of the SOAP 1.1 specification.

  `http://www.w3.org/TR/2000/NOTE-SOAP-20000508/#_Toc478383512`

  The `encodingStyle` attribute for the SOAP 1.1 RPC-encoded message format is expressed with the following value.

  ```
  encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
  ```

- For SOAP 1.2, see "SOAP Encoding", Section 3 of the SOAP 1.2 specification.

  `http://www.w3.org/TR/2003/REC-soap12-part2-20030624/#soapenc`

  The `encodingStyle` attribute for the SOAP 1.2 RPC-encoded message format is expressed with the following value.

  ```
  encodingStyle="http://www.w3.org/2003/05/soap-encoding"
  ```

For information about the issues of interoperability and message formats, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Advantages:

- Backward compatible with older stacks, because this was one of the most common message formats for Web services.
- Supports object graphs (through `id` and `href` attributes).
- Provides additional Java type mapping support indicated by the namespace `http://www.oracle.com/webservices/internal`. For a list of supported data types, see Table 4–1 on page 4-6.

Disadvantages:

- Does not comply with the WS-I Basic Profile.
- More difficult to perform schema validation of the entire message payload

Sample Messages with the RPC-Encoded Message Format Example 4–2 illustrates a request message that uses the RPC-encoded message format. Note that the tag name of the XML element part (`echoString`) sent under the SOAP body (`env:Body`) must be the same as the name of the corresponding WSDL operation. The `env:encodingStyle` attribute indicates the SOAP encoding style being used. Each XML element part (`stringParam`) under the operation element corresponds to a parameter. It must be an instance of `simpleType` or a global type definition. If it is a global type definition, it must be in the WSDL's schema or one of the SOAP encoding extension types.

RPC-encoded request messages to OracleAS Web Services (or RPC-encoded response messages to OracleAS Web Services-generated stubs) can be consumed without `xsi:type` attributes.

Example 4–2 and Example 4–3 apply to SOAP 1.1 messages. To change the examples to apply to SOAP 1.2 messages:

- Change the value of `xmlns:env` to `http://www.w3.org/2003/05/soap-envelope`
- Change the value of `env:encodingStyle` to `http://www.w3.org/2003/05/soap-encoding`

Example 4–2 RPC-Encoded Request Message

```
<env:Envelope
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ns0="http://ws.oracle.com/rpc-enc">
        <env:Body>
                <ns0:echoString

env:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
                        <stringParam>Hello</stringParam>
                </ns0:echoString>
        </env:Body>
</env:Envelope>
```

Example 4–3 illustrates a response message that uses the RPC-encoded message format. RPC-encoded response messages from OracleAS Web Services (or the RPC-encoded request messages from an OracleAS Web Services-generated stub) always contain `xsi:type` attributes.

Example 4–3 RPC-Encoded Response Message

```
<env:Envelope
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:ns0="http://ws.oracle.com/rpc-enc">
        <env:Body>
                <ns0:echoStringResponse

env:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
                        <stringParam xsi:type="xsd:string">Hello</stringParam>
                </ns0:echoStringResponse>
        </env:Body>
</env:Envelope>
```

The xsi:type Attribute in RPC-Encoded Message Formats In many SOAP implementations, messages that use the RPC-encoded message format usually use the `xsi:type` attribute on each element in the message payload. This attribute helps object serialization and deserialization. The `xsi:type` attribute is optional in most cases. The `xsi:type` attribute is required only if the element is an instance of a derived type of an element type defined in the schema. For inbound SOAP messages, OracleAS Web Services accepts messages with or without the `xsi:type` attribute. For outbound SOAP messages in RPC-Encoded format, OracleAS Web Services always emits the `xsi:type` attribute.

Example 4–4 and Example 4–5 apply to SOAP 1.1 messages. To change the examples to apply to SOAP 1.2 messages:

- Change the value of `xmlns:env` to `http://www.w3.org/2003/05/soap-envelope`
- Change the value of `env:encodingStyle` to `http://www.w3.org/2003/05/soap-encoding`

Example 4–4 illustrates a request message for the `echo` operation in RPC-encoded message format. Note that the code sample does not contain the `xsi:type="xsd:string"` attribute.

Example 4–4 RPC-Encoded Request Message Without the xsi:type Attribute

```
<env:Envelope
```

```
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ns0="http://ws.oracle.com/rpc-enc">
   <env:Body>
      <ns0:echo env:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
         <param>some string</param>
      </ns0:echo>
   </env:Body>
</env:Envelope>
```

Example 4–5 illustrates the same request message in RPC-encoded format with the `xsi:type` attribute.

Example 4–5 RPC-Encoded Request Message With the xsi:type Attribute

```
<env:Envelope
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ns0="http://ws.oracle.com/rpc-enc">
   <env:Body>
      <ns0:echo env:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
         <param xsi:type="xsd:string">some string</param>
      </ns0:echo>
   </env:Body>
</env:Envelope>
```

Oracle-Specific Type Support For a complete list of the supported types, see Chapters 4 and 5 of the JAX-RPC 1.1 specification. The JAX-RPC 1.1 specification is available from:

`http://java.sun.com/webservices/jaxrpc/index.jsp`

For completeness, Table 4–1 describes the all of the Java types and Oracle-proprietary types supported by OracleAS Web Services RPC-encoded message format. The Java type mapping support for the types is indicated by the following OracleAS Web Services-specific namespace:

`http://www.oracle.com/webservices/internal`

This namespace accommodates nonstandard XML schema definitions for some standard Java types, such as `Collection`, that are not supported by JAX-RPC 1.1.

> **Note:** The `java.util.Collection` family and `java.util.Map` family are also supported for the literal use (that is, document-literal and RPC-literal). The schema types for these Java types are defined under a different namespace. See "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on how these Java types are supported.

Table 4–1 Java Types Supported by RPC-Encoded Proprietary Message Format

Java Type	Java Classes	Mapping Details
Java primitive types	boolean, byte, double, float, int, long, short	See "Mapping Java Primitive Types to XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*

Table 4–1 (Cont.) Java Types Supported by RPC-Encoded Proprietary Message Format

Java Type	Java Classes	Mapping Details
java.lang Object types	Boolean, Byte, Double, Float, Integer, Long, Short, String	See "Mapping Java Types to XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*
basic Java types	java.math.BigDecimal java.math.BigInteger java.xml.QName java.util.Calendar java.util.Date java.net.URI	See "Mapping Java Types to XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*
Java array types	One-dimensional arrays with elements of supported type	See "Mapping Java Types to XML Types" and "Mapping Java Collection Classes to XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*
Java value types	Java Beans with properties of supported types	See "OracleAS Web Services Support for Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*
attachments **Note:** attachments are not interoperable	java.awt.Image javax.mail.internet.MimeMultipart javax.xml.transform.Source javax.activation.DataHandler	See "Working with Message Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide*
java.util.Collection	java.util.Collection java.util.List java.util.Set java.util.Vector java.util.Stack java.util.LinkedList java.util.ArrayList java.util.HashSet java.util.TreeSet	See "Mapping Java Collection Classes to XML Types" and "Additional Information about Oracle Proprietary XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*
java.util.Map	java.util.Map java.util.HashMap java.util.TreeMap java.util.Hashtable java.util.Properties	See "Mapping Java Collection Classes to XML Types" and "Additional Information about Oracle Proprietary XML Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*

If you want to use any value types which are not built-in (for example, `MyBean`) as items in a `Map` or `Collection`, then you must use the value of the

valueTypeClassName argument to declare these types to the WebServicesAssembler tool when generating the WSDL.

```
java -jar wsa.jar -genWsdl
                  -valueTypeClassName hello.MyBean
                  -valueTypeClassName hello.MyFoo...
```

This allows the generated WSDL to include the schema definitions for these value types. The runtime can then correctly generate the corresponding serialized values. All WebServicesAssembler commands and Ant tasks that assemble Web services bottom up (from Java classes, EJBs, database resources, and so on) support the valueTypeclassName argument. For more information on this argument, see "valueTypeClassName" on page 17-61

For more information on using value type classes that do not conform to the JAX-RPC value type requirements, or that cannot be handled by the default JAX-RPC serialization mechanism, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Restrictions on RPC-Encoded Format OracleAS Web Services does not support the combination of RPC-encoded message formats and databinding=false.

RPC-Literal Message Format

RPC-literal message format complies with WS-I Basic Profile 1.0 and 1.1. This format uses the RPC style of message payload structure but supports the literal way of describing the types passed by a procedure. In this case, literal means that there exists a schema for every parameter type but not for the payload of the message body itself.

For information on interoperability and message formats, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Advantages:

- Complies with WS-I.
- Format of the message part is described by the standard XML schema.

Disadvantages:

- Support for RPC-literal is not consistent across all vendors.
- Does not support object graphs.
- Is not backward compatible with older stacks.
- It is not possible to represent null values for Java method parameters when mapping to WSDL message parts.

Sample Request Message with the RPC-Literal Message Format Example 4–6 illustrates a request message coded for the RPC-literal message format. Note that the tag name of the XML element part (echoString) under the SOAP body (env:Body) must be identical to the name of the corresponding WSDL operation. Each XML element part (stringParam) under the operation element corresponds to a parameter and must be an instance of simpleType or a global type definition. If it is a global type definition, then it must be in the WSDL's schema.

The example applies to SOAP 1.1 messages. For SOAP 1.2 messages, change the value of xmlns:env to http://www.w3.org/2003/05/soap-envelope.

Example 4–6 RPC-Literal Request Message

```
<env:Envelope
        xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ns0="http://ws.oracle.com/rpc-lit">
        <env:Body>
                <ns0:echoString>
                        <stringParam>Hello</stringParam>
                </ns0:echoString>
        </env:Body>
</env:Envelope>
```

Selecting Message Formats

The WebServicesAssembler tool provides arguments that let you control the message format used by a Web service. These arguments let you specify whether the message format is RPC or document (wrapped or bare), encoded or literal.

- style
- use

The following WebServicesAssembler commands allow you to use the `use` and `style` arguments to specify the message format for your Web service.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- genInterface
- genWsdl
- plsqlAssemble
- sqlAssemble

The following example uses the `assemble` command to assemble the Web service server components. The `style` and `use` arguments specify that the message format used is RPC-literal:

```
java -jar wsa.jar -assemble
                  -appName $(app.name)
                  -serviceName HelloServiceWSIF
                  -uri $(app.name)
                  -interface oracle.demo.hello.HelloInterface
                  -className oracle.demo.helllo.HelloImpl
                  -input $(service.classes.dir)
                  -output build
                  -ear dist/$(app.name).ear
                  -style rpc
                  -use literal
```

For more information on the WebServicesAssembler tool and its functionality, see Chapter 17, "Using WebServicesAssembler".

Changing Message Formats in a Service Implementation

You can expose Java service endpoint implementations in RPC-encoded, RPC-literal, or document-literal format. However, if the service endpoint implementation uses the `attachment` data types listed in the Table 4–1, then you can use only RPC-encoded. If none of these additional types are used, then you can use RPC-literal or document-literal format to achieve better interoperability. Each of the formats display similar performance in marshaling between Java objects and XML.

Message Format Recommendations

This section provides some general guidelines for choosing a message format when designing your Web service. When choosing a message format, consider the functionality requirements of the client you want to support. Table 4–2 describes some possible client functionality requirements and suggested message formats.

Table 4–2 Message Format Suggestions, Based on Client Functionality

Client Functionality	Suggested Message Format
OmniPortlet	Use either RPC-encoded or document-literal. The Omniportlet APIs (wizard) does not support RPC-literal.
Oracle XML Query Service (XQS) integration	Use either RPC or document style with the literal use. Oracle XML Query Service does not support SOAP encoding.
XML Schema integration	Reuse the schema definition to describe the SOAP message part of the WSDL operation. This integration can be achieved with either RPC or document style with the literal use.
call-out from an Oracle release 9.2 database	Use RPC-encoded. Oracle release 10.1 or later supports all formats.
expose graph and preserve object identity	Use RPC-encoded. Although RPC-encoded is the easiest way, it can be achieved in document-literal if the model (schema) is well-designed.
WS-I compliance	Use either RPC or document style with the literal use.
BPEL processes	Use document style with the literal use.
Axis 1.2 client	Use either RPC-encoded or document-literal message formats

Working with SOAP Messages

OracleAS Web Services supports SOAP 1.1 and 1.2 messages both programmatically and by using the WebServicesAssembler tool to assemble Web services bottom up and top down.

- OraSAAJ APIs
- Using SOAP 1.2 Formatted Messages in Bottom Up Web Service Assembly
- Using SOAP 1.2 Formatted Messages in Top Down Web Service Assembly

The SOAP with Attachments API for Java (SAAJ) version 1.2 is the programmatic model for representing and working with a SOAP message. The standard SAAJ APIs support SOAP 1.1. You can find more information on SAAJ at the following Web address:

`http://java.sun.com/webservices/saaj/index.jsp`

The Oracle extension of the SAAJ 1.2 API (OraSAAJ) allows a Web service to work with SOAP 1.2 messages.

OraSAAJ APIs

OracleAS Web Services support SAAJ 1.2, which is a specification for modeling SOAP messages with attachments in Java objects. However, the standard SAAJ 1.2 APIs support only SOAP 1.1 messages. To provide programmatic support for SOAP 1.2 messages, OracleAS Web Services includes the `oracle.webservices.soap` package. The interfaces in this package allow you to work with and add information to SOAP 1.2 message objects.

The classes in this package, `VersionedMessageFactory` and `VersionedSOAPFactory`, are extensions to standard SAAJ classes `MessageFactory` and `SOAPFactory`. The methods in the `VersionedMessageFactory` and `VersionedSOAPFactory` classes contain an extra parameter that lets you specify a SOAP message version when using the standard SAAJ APIs.

Table 4–3 Interfaces and Classes in the ORASAAJ API

Interface/Class Name	Description
Body12 interface	Represents a SOAP 1.2 message `Body` object.
Fault12 interface	Provides methods to add SOAP 1.2 `FaultCode` and `FaultReason` elements to a SOAP 1.2 `Fault` element.
FaultCode12 interface	Provides methods to add SOAP 1.2 `FaultValue` and `FaultSubcode` elements to a SOAP 1.2 `FaultCode` element.
FaultReason12 interface	Provides methods to add a SOAP 1.2 `FaultText` element to a SOAP 1.2 `FaultReason` element.
FaultSubcode12 interface	This interface is an extension to the `FaultCode12` interface. It is a marker interface for compiler-enforced strong typing.
FaultText12 interface	Provides methods for adding the text node content and locale information to a `FaultText` element.
FaultValue12 interface	Provides methods to set the fault code on a `FaultValue12` element.
SOAPVersion interface	Provides constants representing the SOAP versions that are available to the platform.
VersionedMessageFactory class	Provides methods for creating a SOAP message. These methods mimic the standard SAAJ `MessageFactory` class, except that they contain an extra parameter for specifying a SOAP message version. One method creates an empty message with standard MIME headers. The other method creates a message based on an input stream and a specified MIME header.
VersionedSOAPFactory class	Provides methods for creating SOAP elements. These methods mimic the standard SAAJ `SOAPFactory` class, except that they contain an extra parameter for specifying a SOAP message version.

For more information on these classes and their methods, see the output of the Javadoc tool for the `oracle.webservices.soap` package at the following Web address:

`http://www.oracle.com/technology/index.html`

Using the OraSAAJ APIs

The OraSAAJ extensions can be used from a `javax.xml.rpc.handler.Handler`. In most cases, the standard `javax.xml.soap.*` classes can be used to manipulate SOAP 1.2 SAAJ messages. However, if you want to use the functionality provided by SOAP 1.2, you must use the OraSAAJ APIs.

Example 4–7 illustrates how the standard `javax.xml.soap.*` classes and the OraSAAJ classes can be used together. The example code creates a SOAP 1.2 message from scratch. The `VersionedMessageFactory` method returns a `javax.xml.soap.SoapMessage` object. This enables you to use the standard `javax.xml.soap.*` methods such as `getBody` and `getEnvelope` on the message.

The `addFault` method adds a SOAP 1.2 fault to the message. To send SOAP 1.2 faults, you must use the OraSAAJ `Fault12`, `FaultCode12`, `FaultValue12`, and `FaultReason12` APIs. This is because SOAP 1.2 faults contain more information than SOAP 1.1 faults.

Example 4–7 Working with the SAAJ and OraSAAJ APIs

```
public boolean handleResponse(MessageContext context) {
    ...
    // create a SOAP 1.2 message from scratch.
    // Note the use of VersionedMessageFactory to get a SOAPMessage
    // for a specific version of soap
    SOAPMessage message =
((VersionedMessageFactory)MessageFactory.newInstance()).createVersionedMessage(ora
cle.webservices.soap.SOAPVersion.SOAP_1_2);
    // Now standard APIs can be used.
    SOAPBody body = message.getSOAPPart().getEnvelope().getBody();
    // However, if you need to send a fault, you must
    // use Oracle-specific APIs, because SOAP 1.2
    // faults contain more information than SOAP 1.1 faults.
    // Note the use of Fault12, FaultCode12, and FaultReason12
    SOAPFault fault = body.addFault();
      Fault12 soapFault = (Fault12) fault;
      FaultCode12 faultCode = soapFault.addCode();
      FaultValue12 faultValue = faultCode.addFaultValue();
      QNameAdapter faultCodeQName = new QNameAdapter("http://my.foo.com/",
                                                     "myFaultCode",
                                                     "foo");
      faultValue.setFaultCode(faultCodeQName);
      FaultReason12 faultReason = soapFault.addReason();
      faultReason.addFaultText().setValue("An unknown error occurred");
    ...
}
```

Using SOAP 1.2 Formatted Messages in Bottom Up Web Service Assembly

To support SOAP version 1.2 messages in bottom up Web service generation, WebServicesAssembler provides a `soapVersion` argument. Values can be "`1.1`", "`1.2`", or "`1.1,1.2`". Default value is "`1.1`".

The "`1.1,1.2`" value means that WebServicesAssembler will create two ports with two bindings. One port and binding will support version 1.1; the other port and binding will support version 1.2. Each port must be bound to a different URL. That is, you cannot support both versions concurrently with the same URL address.

See "soapVersion" on page 17-59 for more information on the WebServicesAssembler `soapVersion` argument.

Using SOAP 1.2 Formatted Messages in Top Down Web Service Assembly

To support SOAP 1.2 messages in top down Web services development, you must supply a WSDL with a SOAP 1.2 binding. A WSDL with a SOAP 1.2 binding contains a set of URIs specific to SOAP 1.2. These URIs are listed in Table 4–4.

Table 4–4 URIs for SOAP 1.2 Messages

URI	Description
http://schemas.xmlsoap.org/wsdl/soap12	The namespace of the SOAP 1.2 binding element that goes into the WSDL `binding` element.
http://www.w3.org/2003/05/soap-encoding	For a SOAP 1.2 message, indicates the encoding rules that the contents of the containing element follows. For more information, see the SOAP Version 1.2 Part 2 Recommendation at: http://www.w3.org/TR/2003/REC-soap12-part2-20030624/
http://www.w3.org/2003/05/soap/bindings/HTTP and http://schemas.xmlsoap.org/soap/http	Describes HTTP transport for SOAP 1.2. Both URIs are accepted by the OracleAS Web Services stack, but the `schemas.xmlsoap.org` URI is more interoperable than the `www.w3.org` URI. Therefore, the `schemas.xmlsoap.org` URI is used when the WSDL is generated for bottom up Web Service assembly.

Example 4–8 displays a WSDL that supports SOAP 1.2 messages. The URIs and elements that are needed to support SOAP 1.2 are displayed in **bold** font.

Example 4–8 Sample WSDL with SOAP 1.2 Binding

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions
     name="Rpclitbottomup"
     targetNamespace="http://www.oracle.ws/rpcliteral"
     xmlns="http://schemas.xmlsoap.org/wsdl/"
     xmlns:tns="http://www.oracle.ws/rpcliteral"
     xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
     xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
     xmlns:tns0="http://www.oracle.ws/rpcliteral/schema"
     xmlns:xsd="http://www.w3.org/2001/XMLSchema"
     xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    >
    <types>
        <schema xmlns="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://www.oracle.ws/rpcliteral/schema"
             elementFormDefault="qualified"
xmlns:tns="http://www.oracle.ws/rpcliteral/schema"
             xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
            <complexType name="HelloMessage">
                <sequence>
                    <element name="longValue" type="long"/>
                    <element name="age" type="int"/>
                    <element name="greeting" type="string" nillable="true"/>
                    <element name="name" type="string" nillable="true"/>
                    <element name="id" type="decimal" nillable="true"/>
                </sequence>
            </complexType>
        </schema>
    </types>
```

```
    <message name="HelloInterface_hello">
        <part name="msg" type="tns0:HelloMessage"/>
    </message>
    <message name="HelloInterface_helloResponse">
        <part name="result" type="tns0:HelloMessage"/>
    </message>
    <portType name="HelloInterface">
        <operation name="hello" parameterOrder="msg">
            <input message="tns:HelloInterface_hello"/>
            <output message="tns:HelloInterface_helloResponse"/>
        </operation>
    </portType>
    <binding name="HelloInterfacePortBinding" type="tns:HelloInterface">
        <soap12:binding style="rpc"
transport="http://schemas.xmlsoap.org/soap/http"/>
        <operation name="hello">
            <soap12:operation soapAction="http://www.oracle.ws/rpcliteral/hello"
soapActionRequired="false"/>
            <input>
                <soap12:body use="literal"
namespace="http://www.oracle.ws/rpcliteral" parts="msg"/>
            </input>
            <output>
                <soap12:body use="literal"
namespace="http://www.oracle.ws/rpcliteral" parts="result"/>
            </output>
        </operation>
    </binding>
    <service name="Rpclitbottomup">
        <port name="HelloInterfacePort" binding="tns:HelloInterfacePortBinding">
            <soap:address location="REPLACE_WITH_ACTUAL_URL"/>
        </port>
    </service>
</definitions>
```

Converting XML Elements to SOAP Elements

The `oracle.webservices` package provides a `toSOAPElement` method in the `SOAPUtil` class to convert XML elements (`org.w3c.dom.Element`) to SOAP elements (`javax.xml.soap.SOAPElement`).

Example 4–9 illustrates a code sample that creates an XML document, converts it to a SOAP element, and prints it to the standard output.

Example 4–9 Converting an XML Element to a SOAP Element

```
...
try {
   DOMParser parser = new DOMParser();
   parser.parse(new StringReader(
      "<Flds:CustomerGroup xmlns:Flds=\"http://foo.com/foo.xsd\">
      "<Flds:Customer>xyz</Flds:Customer>
      "</Flds:CustomerGroup>"));

   SOAPElement se = SOAPUtil.toSOAPElement(
      parser.getDocument().getDocumentElement());
   ((XMLElement)se).print(System.out);
} catch (Exception ex) {
   ex.printStackTrace();
}
```

. . .

Limitations

See "OracleAS Web Services Messages" on page C-1.

Additional Information

For more information on:

- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- message attachments, and using attachments in your Web service, see "Working with Message Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide*
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

5

Assembling a Web Service from a WSDL

This chapter describes how to assemble a Web service, starting with a Web Service Description Language (WSDL) file. This is also known as top down Web service generation.

What Is Top Down Assembly?

In top down Web service assembly, you generate a service from an existing WSDL file that models the business processes you want to expose.

A development tool, such as WebServiceAssembler, uses the WSDL to generate the service endpoint interface for the service. You can then implement the service for any supported architecture, such as Java classes. After compiling the implementation, you generate the service and deploy it to the application server.

Chapter 4, "Oracle Application Server Web Services Messages" provides information about the message formats you can assign to a Web service.

How to Assemble a Web Service Top Down

This section describes what you must provide to assemble a Web service top down. Assembling a Web service requires the WebServiceAssembler tool, and Java platform tools such as the `javac` compiler, that are found in the J2SE 1.4 SDK distribution.

There are three general steps for generating a Web service top down:

1. Generate the service endpoint interface.

   WebServicesAssembler can perform this step.

2. Implement and compile the services.

   The developer performs this step.

3. Assemble the services.

   WebServicesAssembler can perform this step. "Generating the Web Service Top Down" on page 5-2 provides more detail on each of these steps.

Prerequisites

Generating a Web service top down with WebServiceAssembler requires you to specify only the WSDL and an output directory.

Before you generate Web services, consider these issues:

- WebServicesAssembler places some restrictions on the WSDL that you specify:

  - The WSDL should comply with Web Services-Interoperability (WS-I) Basic Profile 1.0. If it does not, WebServiceAssembler provides command-line arguments that enable you to work around many limitations in the WSDL. Chapter 17, "Using WebServicesAssembler" provides descriptions of WebServicesAssembler commands and arguments.
  - Only one service element can be implemented. WebServicesAssembler enables you to generate the artifacts for only one service at a time. If more than one service is described in the WSDL, a command line argument, `serviceName`, enables you to specify the service you want to use.
  - The message format is specified in the WSDL. You cannot use WebServicesAssembler to change the message format in top down Web service development.
  - The WSDL cannot contain multiple message formats. Remove any ports from the WSDL that reference a binding with a message format that you do not want to use.

- If you use nonstandard data types, as described in "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and Table 4–1 on page 4-6, ensure that the `oracle-webservices.xml` deployment descriptor defines how they will be handled. This file can be used to identify the name of the serialization class that converts the data between XML and Java, the name of the Java class that describes the Java representation of the data, and so on.

  "oracle-webservices.xml Deployment Descriptor" on page 18-12 provides more information on this deployment descriptor. "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on working with nonstandard data types
- Decide whether you want to use wrapped or unwrapped parameters. To control this, WebServicesAssembler provides the `unwrapParameters` command-line option.

Generating the Web Service Top Down

The following steps illustrate how to assemble a Web service top down. The Web service will provide a logging facility that is defined by the WSDL stored at `wsdl/LoggingFacility.wsdl`.

1. Provide a WSDL from which the Web service will be generated as input to the WebServiceAssembler `genInterface` command. For example:

```
java -jar wsa.jar -genInterface
                  -output build/src/service
                  -wsdl wsdl/LoggingFacility.wsdl
                  -unwrapParameters false
                  -packageName oracle.demo.topdowndoclit.service
                  -mappingFileName type-mapping.xml
```

   At a minimum, specify the name of the WSDL. For more information on the required and optional arguments to `genInterface`, see "genInterface" on page 17-29.

   The WebServiceAssembler tool generates a Java interface for every port type specified in the WSDL, and a Java Bean for each complex type. The name of the directory that stores the generated interface is based on the values of the `output` and `packageName` arguments. For this example, the generated interface is stored

in `build/src/service/oracle/demo/topdowndoclit/service`. The value types are stored in the specified output directory, but the package name is based on the type namespace or values in the JAX-RPC mapping file, `type-mapping.xml`.

2. Compile the generated interface and type classes. For example:

```
javac build/src/service/*.java -destdir build/classes
```

3. Create the service endpoint implementation for your Web service.

   The Java service endpoint must have a method signature that matches every method in the generated Java interface.

4. Compile the Java service endpoint.

   For example, you can use the same command as in Step 2 if the Java service endpoint interface source was generated in the same directory where the `Impl` class was saved. If it was not, then you must change the value of the `path` argument.

5. Assemble the service by running the WebServiceAssembler tool with the `topDownAssemble` command. For example:

```
java -jar wsa.jar -topDownAssemble
            -wsdl ./wsdl/LoggingFacility.wsdl
            -unwrapParameters false
            -className oracle.demo.topdowndoclit.service.DocLitLoggerImpl
            -input build/classes/service
            -output build
            -ear dist/doclit_topdown.ear
            -mappingFileName type-mapping.xml
            -packageName oracle.demo.topdowndoclit.service
            -fetchWsdlImports true
            -classPath ./build/classes/client
```

   At a minimum, specify the name of the WSDL, the class name that implements the service, and the name of the output directory. The WebServiceAssembler tool outputs an EAR file, and a WAR file within the EAR. The WAR file contains the service artifacts, the implementation classes, the Web deployment descriptor (`web.xml`) and the JAX-RPC deployment descriptor (`webservices.xml`). For more information on the required and optional arguments to `topDownAssemble`, see "topDownAssemble" on page 17-20.

6. Deploy the service.

   Deploy the EAR file in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*. The following is a sample deployment command.

```
java -jar <oc4jHome>/j2ee/home/admin_client.jar deployer:oc4j:localhost:port
<user> <password>
            -deploy
            -file dist/doclit_topdown.ear
            -deploymentName doclit_topdown
            -bindWebApp default-web-site
```

   The following list describes the parameters in this code example:

   - *<oc4j_Home>*—the directory containing the OC4J installation.
   - *<user>*—the user name for the OC4J instance. The user name is assigned at installation time.

- *<password>*—the password for the OC4J instance. The password is assigned at installation time.
- doclit_topdown—the name of the application.
- default-web-site—the Web site to which the application will be bound. This is usually default-web-site. To configure Web sites, see the server.xml file in *<oc4j_home>*/j2ee/home/config.

7. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.
8. Generate the client code:
   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the genProxy command. For more information on generating and assembling client-side code for a J2SE Web service, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the genInterface command. For more information on generating and assembling client-side code for a J2EE Web service, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command generates client proxies (stubs) that can be used for a J2SE client:

```
java -jar wsa.jar -genProxy
                -wsdl http://localhost:8888/doclit_topdown/doclit_topdown?WSDL
                -unwrapParameters false
                -output build/src/client
                -packageName oracle.demo.topdowndoclit.stubs
                -mappingFileName type-mapping.xml
```

   In this example, doclit_topdown is an application name for the generated Web service.

   At a minimum, specify the name of the WSDL and the name of the output directory. The WebServiceAssembler tool generates a stub. A client application uses the stub to invoke operations on a remote service. For more information on the required and optional arguments to genProxy, see "genProxy" on page 17-30.
9. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, wsclient_extended.jar on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on wsclient_extended.jar and the client classpath.

Generating a Web Service Top Down with Ant Tasks

The current release supports Ant tasks for Web services development. The following examples show how the WebServiceAssembler commands in the preceding examples can be rewritten as Ant tasks.

In these examples, `doclit_topdown` is an application name for the generated Web service.

For more information on Ant tasks for WebServiceAssembler commands, see "WebServicesAssembler Commands" on page 17-3.

For the `genInterface` command, here is an example Ant task:

```
<oracle:genInterface wsdl="wsdl/LoggingFacility.wsdl"
              output= "build/src/service"
              packageName= "oracle.demo.topdowndoclit.service"
              mappingFileName="type-mapping.xml"
              dataBinding="true"
              unwrapParameters="false"
/oracle:genInterface>
```

For the `topDownAssemble` command, here is an example Ant task:

```
<oracle:topDownAssemble appName="doclit_topdown"
         wsdl="./wsdl/LoggingFacility.wsdl"
         unwrapParameters="false"
         input="build/classes/service "
         output="build"
         ear="dist/doclit_topdown.ear"
         mappingFileName="type-mapping.xml"
         packageName="oracle.demo.topdowndoclit.service"
         fetchWsdlImports="true"
         >
            <oracle:portType
               className="oracle.demo.topdowndoclit.service.DocLitLoggerImpl"
            </oracle:portType>
  />
```

For the `genProxy` command, here is an example Ant task:

```
<oracle:genProxy
    wsdl="http://localhost:8888/doclit_topdown/doclit_topdown?WSDL"
    unwrapParameters="false"
    output="build/src/client"
    packageName="oracle.demo.topdowndoclit.stubs"
    mappingFileName="type-mapping.xml"
/>
```

Limitations

See "Assembling Web Services from a WSDL" on page C-4.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building a J2EE client, see Chapter 13, "Assembling a J2EE Web Service Client".
- building a J2SE client, see Chapter 14, "Assembling a J2SE Web Service Client".
- JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".

- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".
- Web services interoperability, see "Ensuring interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Service" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

6

Assembling a Web Service with Java Classes

This chapter describes how to assemble stateless and stateful Web services based on Java classes. The Web service assembly is performed bottom up by WebServicesAssembler.

A stateless Web service does not carry any local state across calls. In contrast, a stateful Web service may carry state across calls, and the results of method invocations depend on the scope. The stateful Web services supported by Oracle Application Server Web Services is HTTP-based. It works only for SOAP/HTTP endpoints and not for SOAP/JMS endpoints.

Stateless Web services interoperate with .NET or any vendor's Web services. Stateful OracleAS Web Services based on Java classes contain Oracle-proprietary extensions and may not operate with other services unless the service provider makes available scopes with the same semantics.

This chapter has the following sections:

Exposing Java Classes as a Stateless Web Service

You can use WebServicesAssembler to assemble Web services from Java classes that conform to the JAX-RPC 1.1 specification. Exposing Java classes as a Web service is convenient if you want a lightweight system and do not need the transactional capabilities that an EJB container offers.

WebServicesAssembler assembles the service bottom up. It starts with the Java classes you want to expose as a Web service and generates a deployable EAR file containing the WSDL, the mapping files, the implementation files, and the deployment descriptors.

JAX-RPC requires you to provide a Java class that contains the methods you want to expose as a service and its interface. For more information on the requirements on the class and interface, see "Writing Java Class-Based Web Services" on page 6-4.

A Web service based on Java classes can be invoked by a client written in Java, .NET, or any other programming language. The client can be based on static stub or Dynamic Invocation Interface (DII).

Prerequisites

Before you begin, provide the following files and information.

- Supply a compiled Java class and interface that contains the methods that you want to expose as a service. The class and its interface must conform to the JAX-RPC standards for a Web service. If you are exposing Java classes as a stateless Web service, see "Writing Stateless Web Services" on page 6-5. If you are exposing Java classes as a stateful Web service, see "Exposing Java Classes as a Stateful Web Service" on page 6-7.
- Decide whether you want WebServicesAssembler to only generate the service files or if you want it to package the files into a deployable archive. The `ear` argument packages the files into an archive. If you do not specify `ear`, then the files are stored in a directory specified by `output`. For more information on these arguments, see "ear" on page 17-38, "output" on page 17-42, and "war" on page 17-45.
- If the methods in the Java class use nonstandard data types, such as those described in "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and in Table 4–1 on page 4-6, you must specify a custom serializer to process them. For more information on using nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*. For a list of the supported data types, see the JAX-RPC 1.1 specification available from: `http://java.sun.com/webservices/jaxrpc/index.jsp`.
- If your Java classes need to work with any additional message processing components, for example to provide reliability and security features, you can specify message handlers. For more information, see "Configuring Handlers in an Ant Task" on page 17-71 and Chapter 16, "Processing SOAP Headers".

How to Assemble a Stateless Web Service

The following steps describe how to use WebServicesAssembler to expose a stateless Web service from a Java class:

1. Provide the compiled Java class that you want to expose as a Web service and its compiled interface.

   This example uses the `HelloInterface` interface and the `HelloImpl` class. You can find code listings of these files in "Defining a Java Interface" on page 6-6 and "Defining a Java Class" on page 6-6.

2. Generate the service artifacts by running the WebServicesAssembler with the `assemble` command. This example assumes that the interface and implementation classes are compiled to the `./build/classes/service` directory.

```
java -jar wsa.jar -assemble
    -appName hello
    -serviceName HelloService
    -interfaceName oracle.demo.hello.HelloInterface
    -className oracle.demo.hello.HelloImpl
    -input ./build/classes/service
    -output build
    -ear dist/hello.ear
    -uri HelloService
    -targetNamespace http://hello.demo.oracle
```

The output of this command is an EAR file that contains the contents of a WAR file that can be deployed to an OC4J instance. The `dist` directory contains the J2EE Web services-compliant application EAR file, `hello.ear`. For more information on the required and optional arguments to `assemble`, see "assemble" on page 17-7.

3. Deploy the service and bind the application.

   Deploy EAR files in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*. The following is a sample deployment command:

   ```
   java -jar <OC4J_HOME>/j2ee/home/admin_client.jar deployer:oc4j:localhost:port
   <user> <password>
               -deploy
               -file dist/hello.ear
               -deploymentName hello
               -bindWebApp default-web-site
   ```

   The following list describes the variables used in this code example.

   - *<OC4J_Home>*—The directory containing the OC4J installation.
   - *<user>*—The user name for the OC4J instance. The user name is assigned at installation time
   - *<password>*—The password for the OC4J instance. The password is assigned at installation time
   - `default-web-site`—The Web site to which the application will be bound. This is usually `default-web-site`. To configure Web sites, see the `server.xml` file in `<OC4J_HOME>/j2ee/home/config`.

4. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web service home page.

5. Generate the client-side code:

   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling client-side code for the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a Service Endpoint Interface and a mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling client-side code, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command generates stubs that can be used for a J2SE client:

   ```
   java -jar wsa.jar -genProxy
                     -output build/src/client/
                     -wsdl http://localhost:8888/hello/HelloService?WSDL
                     -packageName oracle.demo.hello
   ```

   This command generates the client proxies and stores them in the directory `build/src/client`. The client application uses the stub to invoke operations on

a remote service. For more information on the required and optional arguments to `genProxy`, see "genProxy" on page 17-30.

6. Write the client application.
7. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

Ant Tasks for Generating a Stateless Web Service

The current release provides Ant tasks for Web services development. The following code samples show how the WebServicesAssembler commands in the preceding examples can be rewritten as Ant tasks.

For more information on Ant tasks for WebServicesAssembler commands, see Chapter 17, "Using WebServicesAssembler".

For the `assemble` command, here is an example Ant task. In this example, `build/classes/client` is the directory where client classes (stubs) will be generated.

```
<oracle:assemble appName="hello"
        serviceName="HelloService"
        input="./build/classes/service"
        output="build"
        ear="dist/hello.ear"
        targetNamespace="http://hello.demo.oracle"
        >
            <oracle:porttype
                interfaceName="oracle.demo.hello.HelloInterface"
                className="oracle.demo.hello.HelloImpl">
                <oracle:port uri="HelloService" />
            </oracle:porttype>
            <oracle:classpath>
                <pathelement location="build/classes/client"/>
            </oracle:classpath>
</oracle:assemble>
```

For the `genProxy` command, here is a sample Ant task. The client proxies will be stored in the directory `build/src/client`.

```
<oracle:genProxy  wsdl="http://localhost:8888/hello/HelloService?WSDL"
          output="build/src/client"
          packageName="oracle.demo.hello"
/>
```

Writing Java Class-Based Web Services

To use JAX-RPC to create a Web service with Java files, you must provide a public interface that defines the remote methods that you want to expose as a service. The interface definition must also extend `java.rmi.Remote`, and its methods must throw a `java.rmi.RemoteException` object. The interface must also reside in a package.

You can also use the public interface to list the signatures for the public methods, or public methods with supported data types, that you want to make available to the Web service. That is, you can employ the interface to filter the methods that you want to expose.

The implementation of the interface must satisfy other requirements:

- The class must contain a default public constructor.
- The class methods must implement the methods of the Service Endpoint Interface.
- Class methods must not be final.
- For stateful Web services, the class must implement `java.io.Serializable`.
- The class must reside in a package.
- All methods in the interface must throw `java.rmi.RemoteException`. In addition, methods can declare other, specific exceptions. These must extend `java.lang.Exception` directly or indirectly but must not be a `RuntimeException`.
- Method parameters and return types must be JAX-RPC supported Java types. "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides a list of supported Java types.
- Holder classes can be used as method parameters. These holder classes are either generated or derived from the `javax.xml.rpc.holders` package.
- The implementation class must not include public final static declarations.
- A service endpoint interface must not include a remote reference (a class that implements `RemoteInterface`) as either a parameter or a return type. A Java array or JAX-RPC value type must not include a remote reference as a contained element.

For a description of all of the requirements on the interface, see the Enterprise Web Services 1.1 specification at the following Web address:
`http://www.jcp.org/aboutJava/communityprocess/final/jsr109/index.html`

When a Web service client makes a service request, OC4J runs the corresponding method in that class. There are very few restrictions on what actions the Web service can perform. At a minimum, the Web services generate some data that is sent to the client or perform an action specified by a Web service request.

The following sections illustrate how to write stateless Web services based on Java classes. For information on writing stateful Web services based on Java classes, see "Exposing Java Classes as a Stateful Web Service" on page 6-7.

Writing Stateless Web Services

OracleAS Web Services supports stateless implementations for Java classes running as Web services. For a stateless Java implementation, OracleAS Web Services creates multiple instances of the Java class in a pool; any one of the instances can be used to service a request. After servicing the request, the object is returned to the pool for use by a subsequent request.

Developing a stateless Java Web service consists of the following steps:

- Defining a Java Interface
- Defining a Java Class

Defining a Java Interface

Example 6–1 displays the `HelloInterface.java` interface for the stateless Web service. To comply with the JAX-RPC 1.1 specification, the interface must reside in a package. It must also extend `java.rmi.Remote`, and its methods must throw a `java.rmi.RemoteException` object.

Example 6–1 Defining an Interface for a Stateless Web Service

```
package oracle.demo.hello;

import java.rmi.RemoteException;
import java.rmi.Remote;

public interface HelloInterface extends Remote {
    public String sayHello(String name) throws RemoteException;
}
```

Defining a Java Class

Create a Java class by implementing the methods in the interface that you want to expose as a Web service. A Java class for a Web service usually defines one or more public methods. To comply with the JAX-RPC 1.1 specification, the implementation class must reside in a package. It must also import `java.rmi.Remote` and `java.rmi.RemoteException`.

Example 6–2 displays the public class, `HelloImpl`. This class defines a public method, `sayHello`, that returns the string `"Hello` *name*`!"` where *name* is an input value.

Example 6–2 Defining a Public Class for a Stateless Web Service

```
package oracle.demo.hello;

import java.rmi.RemoteException;
import java.rmi.Remote;

public class HelloImpl {
     public HelloImpl() {
   }
   public String sayHello(String name) {
     return ("Hello " + name + "!");
   }
}
```

Notice that Java class Web service implementations must include a public constructor that takes no arguments.

When an error occurs while running a method on the Java class, it throws a `RemoteException`. In response to the exception, OracleAS Web Services returns a Web service (SOAP) fault. Use standard J2EE and OC4J administration facilities to view errors for a Web service that uses Java classes for its implementation.

When you create a Java class containing methods that implement a Web service, the methods, parameters, and return values must use supported types or nonstandard types supported by OracleAS Web Services. For a list of the supported data types, see the JAX-RPC 1.1 specification available from the following Web site:

`http://java.sun.com/webservices/jaxrpc/index.jsp`

"Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and Table 4–1 on page 4-6 provides lists of supported data types and supported nonstandard types.

If methods, parameters, and return values use unsupported types, then you must handle them in either of the following ways.

- Use the interface class to limit the exposed methods to only those using JAX-RPC supported types and the supported non-standard types.
- Use the custom serializer to map unsupported types. For more information on working with unsupported types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Exposing Java Classes as a Stateful Web Service

OC4J supports stateful Web services based on Java classes. The Java object that implements the service persists for the duration of the HTTP session. To maintain state, these services contain Oracle-proprietary extensions. Because of these extensions, you should not consider stateful OracleAS Web Services to be interoperable unless the service provider makes available scopes with the same semantics.

The stateful Web services supported by OracleAS Web Services is HTTP-based. It works only for SOAP/HTTP endpoints and does not work for SOAP/JMS endpoints.

Prerequisites

The prerequisites for generating a stateful Web service from Java classes are identical to those described for a stateless Web service. For a description of the information and files you must provide, see "Prerequisites" on page 6-2.

How to Assemble a Stateful Web Service

The following instructions describe how to use WebServicesAssembler to create a stateful Web service from a Java class. The Java object that implements the service persists for the duration of the HTTP session.

1. Provide the Java class that you want to expose as a Web service and its interface.
2. Generate the service artifacts by running the WebServicesAssembler with the `assemble` command. For example:

```
java -jar wsa.jar -assemble
    -appName counter
    -serviceName counterService
    -interfaceName oracle.demo.count.CounterInterface
    -className oracle.demo.count.CounterImpl
    -input build/classes/service
    -output build
    -ear dist/counter.ear
    -recoverable true
    -timeout 30
    -uri counterService
```

Note the `timeout` argument on the command line. In addition to indicating the number of seconds an HTTP session should last before it times out, it also implicitly sets the `session` argument to `true`. When `session` is `true`, the service instance is stored in an HTTP session. The `recoverable` argument

indicates that this stateful application is distributable. For more information on the required and optional arguments to `assemble`, see "assemble" on page 17-7.

This command generates all the files required to create a deployable archive. The output `build` directory contains separate directories for the EAR file and the Java classes. The `dist` directory contains the J2EE Web services-compliant application EAR file, `counter.ear`.

3. Deploy the service and bind the application.

   Deploy the EAR file in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*. The following is a sample deployment command.

```
java -jar <OC4J_HOME>/j2ee/home/admin_client.jar deployer:oc4j:localhost:port
<user> <password>
          -deploy
          -file dist/counter.ear
          -deploymentName counter
          -bindWebApp default-web-site
```

   The following list describes the parameters used in this code example.

   - *<OC4J_HOME>*—The directory containing the OC4J installation.
   - *<user>*—the user name for the OC4J instance. The user name is assigned at installation time.
   - *<password>*—the password for the OC4J instance. The password is assigned at installation time.
   - `default-web-site`— the Web site to which the application will be bound. This is usually `default-web-site`. To configure Web sites, see the `server.xml` file in *<OC4J_HOME>*`/j2ee/home/config`.

4. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web service home page.

5. Generate the client code:

   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling client-side code for the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a Service Endpoint Interface and a mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling client-side code, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command generates client proxies (stubs) that can be used for a J2SE client:

```
java -jar wsa.jar -genProxy
                  -output build/src/client/
                  -wsdl http://localhost:8888/counter/counterService?WSDL
                  -packageName oracle.demo.count
```

This command generates the client proxies and stores them in the directory `build/src/client`. The client application uses the stub to invoke operations on a remote service. For more information on the required and optional arguments to `genProxy`, see "genProxy" on page 17-30.

> **Note:** On systems such as Unix or Linux, the URL might need to be quoted (" ") on the command line.

6. Write the client application.

   Ensure that the client participates in the session by setting the `SESSION_MAINTAIN_PROPERTY` runtime property (`javax.xml.rpc.session.maintain`) to `true` either on the stub, the DII call, or the endpoint client instance.

   Instead of setting this property directly, OracleAS Web Services provides a helpful wrapper class with a `setMaintainSession(boolean)` method. Set this method to `true` to maintain sessions. The wrapper takes care of setting the property inside of the client. For example, in the client code, enter:

   ```
   CounterServicePortClient c = new CounterServicePortClient();
   //sets Maintain Session to true, as the endpoint is stateful.
   c.setMaintainSession(true);
   ```

7. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

Ant Tasks for Generating a Stateful Web Service

The current release provides Ant tasks for Web service development. The following code samples show how the WebServicesAssembler commands in the preceding examples can be rewritten as Ant tasks.

For the `assemble` command, here is an example Ant task. In this example, `${wsdemo.common.class.path}` represents the classpath.

```
<oracle:assemble appName="counter"
            serviceName="counterService"
            input="build/classes/service"
            output="build"
            ear="dist/service.ear"
            recoverable="true"
            timeout="30        "
        >
        <oracle:porttype
            interfaceName="oracle.demo.count.CounterInterface"
            className="oracle.demo.count.CounterImpl">
            <oracle:port uri="counterService" />
        </oracle:porttype>
        <oracle:classpath>
            <pathelement path="${wsdemo.common.class.path}"/>
```

```
            <pathelement location="build/classes/client"/>
        </oracle:classpath>
    </oracle:assemble>
```

For the `genProxy` command, here is an example Ant task.

```
<oracle:genProxy wsdl="http://stadp54.us.oracle.com:8888/counter/counter?WSDL"
    output="build/src/client"
    packageName="oracle.demo.count"/>
```

Writing Stateful Web Services

Java implementations for a stateful Web service must meet the same requirements as implementations for a stateless service. "Writing Java Class-Based Web Services", on page 6-4 describes these requirements.

In addition, OC4J supports the `call`, `session`, and `endpoint` scope for a stateful Java implementation:

- `call`—The class instance is created for each call. The instance is garbage collected after each call. The value of the callScope argument determines whether the class instance is created for each call.
- `session`—The class instance is stored in an HTTP session. This applies only for HTTP transport. Session timeout can be tuned by the `timeout` argument. The value of the session argument determines whether the class instance is stored in an HTTP session.
- `endpoint`—The service endpoint implementation class instance is a singleton instance for each endpoint. This is the default scope.

Developing a stateful Java Web service consists of the following steps:

- Defining a Java Interface
- Defining a Java Class

Defining a Java Interface

Example 6–3 displays the `CountInterface.java` interface for the stateful Web service. This example also shows that the service class does not have to implement the Service Endpoint Interface directly. To comply with the JAX-RPC 1.1 specification, the interface must reside in a package. It must also extend `java.rmi.Remote` and its methods must throw a `java.rmi.RemoteException` object.

Example 6–3 Defining an Interface for a Stateful Web Service

```
package oracle.demo.count;

import java.rmi.RemoteException;
import java.rmi.Remote;

public interface CounterInterface extends Remote {
    // gets the current counter value
    public int getCurrentCounter() throws RemoteException;
}
```

Defining a Java Class

Create a Java class by implementing the methods in the interface that you want to expose as a Web service. A Java class for a Web service usually defines one or more public methods. To comply with the JAX-RPC 1.1 specification, the implementation

class must reside in a package. It must also import `java.rmi.Remote` and `java.rmi.RemoteException`.

Example 6–4 displays the public class, `CounterImpl`. The class initializes the count and defines the public method, `getCurrentCounter`.

Example 6–4 Defining a Public Class for a Stateful Web Service

```
package oracle.demo.count;

import java.rmi.RemoteException;
import java.rmi.Remote;

public class CounterImpl implements java.io.Serializable {
    private int counter = 0;

    public CounterImpl() {
    }

  public int getCurrentCounter() {
      System.out.println("Current counter value is: " + (++counter));
      return (counter);
   }
}
```

Packaging and Deploying Web Services

The packaging of Web services that expose Java classes is described in "Packaging for a Web Service Based on Java Classes" on page 18-2.

For a detailed description of Web module deployment, see the *Oracle Containers for J2EE Deployment Guide*.

Tool Support for Exposing Java Classes as Web Services

With Oracle JDeveloper, you can create, modify, and deploy J2EE-compliant Java class files as Web services. When you create Java classes in JDeveloper, you use the modeling tools and wizards. The wizards can perform the following tasks.

- Import or create Java classes and interfaces in a project.
- Package and deploy the Java classes exposed as Web services.

For more information on using JDeveloper to create Java classes and expose them as Web services, see the JDeveloper on-line help.

Limitations

See "Assembling Web Services from Java Classes" on page C-4.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building a J2EE client, see Chapter 13, "Assembling a J2EE Web Service Client".
- building a J2SE client, see Chapter 14, "Assembling a J2SE Web Service Client".

- JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Service" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

7

Assembling a Web Service with EJBs

This chapter describes how to use the WebServicesAssembler tool to expose version 2.1 Enterprise Java Beans (EJBs) as Web services.

This chapter has the following sections.

Exposing EJBs as Web Services

You can use WebServicesAssembler to expose version 2.1 EJBs as Web services that conform to J2EE 1.4 standards. Many EJBs have been written to encapsulate business functions in the middle tier. If you use EJBs in your enterprise applications, you can expose them as Web services.

> **Note:** WebServicesAssembler cannot be used to expose version 3.0 EJBs as a Web service.

EJB components, by design, are meant for distributed computing and are well-suited for exposure as Web services. The EJB specification supports declarative transactions, thread management, and role-based security. You can leverage these benefits if you decide to use EJB components as Web services. EJBs exposed as Web services can still be accessed by traditional RMI EJB clients as well as by SOAP protocols. J2EE 1.4 allows exposing only stateless session beans as Web services.

By their nature, SOAP and Web services are stateless. Therefore, stateless session beans are an ideal medium for exposure as Web services. Stateless session beans can be used for checking someone's credit, charging a bank account, or placing an order. Session beans that implement a business function to be used by other remote applications are a perfect fit for exposure as Web services.

Writing an EJB Web service using JAX-RPC involves writing an EJB that implements a service and provides an interface for it. The EJB should contain the business logic that a client can invoke when it makes a Web service request.

An EJB Web service does not differ from any other Web service and can be invoked by a client written in Java, .NET, or any other programming language. The client of an EJB Web service can leverage static stubs, dynamic proxies, or Dynamic Invocation Interfaces (DII).

These are the general steps for exposing an EJB as a Web service.

1. Create the service endpoint interface for the stateless EJB component.

   The developer performs this step.

2. Assemble the service artifacts. This includes generating the WSDL and mapping files, and packaging the application into a deployable archive.

   WebServicesAssembler can be used to perform this step.

"How to Assemble a Web Service from an EJB" describes these steps in greater detail.

Working with Version 2.0 EJBs

Although this chapter focuses on exposing version 2.1 EJBs as Web services, version 2.0 EJBs can also be exposed. All the functionality in Oracle Application Server Web Services for working with version 2.1 EJBs is also available for version 2.0 EJBs. OracleAS Web Services and WebServicesAssembler can detect version 2.0 EJBs and ensure that they are processed correctly. Its remote interface methods must define the methods to be exposed as a Web service.

For more information on the J2EE Web Services requirements for EJBs, see "Writing EJBs for Web Services" on page 7-5.

Prerequisites

Before you begin, provide the following files and information.

- Write an Enterprise Java Bean that contains the business functions that you want to expose and its interface. The EJB and its interface must conform to EJB 2.1 standards and the J2EE 1.4 standard for a Web service. For more information on these requirements, see "Writing EJBs for Web Services" on page 7-5.
- Decide whether you want WebServicesAssembler to only generate the service files or generate and package the files into a deployable archive. The `ear` argument packages the files into an archive. If you do not specify `ear`, the files are stored in a directory specified by `output`. For more information on output and packaging arguments, see "ear" on page 17-38, "output" on page 17-42, and "war" on page 17-42.
- If the methods in the EJB use nonstandard data types, such as those described in "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and in Table 4–1 on page 4-6, you must specify a custom serializer to process them. For more information on implementing a custom serializer, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- If your EJB needs to work with any additional message processing components, for example to process SOAP header information, you can specify message handlers. For more information, see "Configuring Handlers in an Ant Task" on page 17-71 and Chapter 16, "Processing SOAP Headers".

How to Assemble a Web Service from an EJB

The following steps describe how to use WebServicesAssembler to expose a session bean as a Web service.

1. Write the EJB that you want to expose as a Web service and its service endpoint interface.
2. Inspect the `ejb-jar.xml` deployment descriptor.

Enter a `<service-endpoint>` element and a value if it is not already in the file. This element identifies the service endpoint interface for this Web service. In the following `ejb-jar.xml` fragment the `<service-endpoint>` element is highlighted in bold.

```
<enterprise-beans>
    <session>
        <ejb-name>HelloServiceBean</ejb-name>
        <service-endpoint>oracle.demo.ejb.HelloServiceIntf</service-endpoint>
        <ejb-class>oracle.demo.ejb.HelloserviceBean</ejb-class>
        <session-type>Stateless</session-type>
        <transaction-type>Container</transaction-type>
    </session>
</enterprise-beans>
```

3. Generate the service artifacts by running the WebServicesAssembler tool with the `ejbAssemble` command. For example:

```
java -jar wsa.jar -ejbAssemble
               -appName helloServices-ejb
               -ear dist/helloServices-ejb.ear
               -output build
               -targetNamespace http://oracle.j2ee.ws/ejb/Hello
               -typeNamespace http://oracle.j2ee.ws/ejb/Hello/types
               -input dist/HelloServiceejb.jar
               -ejbName HelloServiceBean
```

This command assembles the EJB 2.1 Web service by generating the WSDL and mapping files, and packaging the application into a deployable archive, `dist/helloServices-ejb.ear`. This archive contains the `helloService-ejb.jar`, which stores all of the service artifacts, such as the EJB implementation classes, the generated WSDL and mapping file, standard Web service descriptor file, `webservices.xml`, and the Oracle-proprietary deployment descriptor file `oracle-webservices.xml`. For more information on the `ejbAssemble` command, see "ejbAssemble" on page 17-13.

4. Deploy the service and bind the application.

EAR files are deployed into a running instance of OC4J. For more information on deployment, see the *Oracle Containers for J2EE Deployment Guide*. The following is a sample deployment command.

```
java -jar <OC4J_HOME>/j2ee/home/admin_client.jar deployer:oc4j:localhost:port
<user> <password>
            -deploy
            -file dist/ejbApp.ear
            -deploymentName ejbApp
            -bindWebApp default-web-site
```

The following list describes the parameters in this code example.

- *<OC4J_HOME>*—the directory containing the OC4J installation.
- *<user>*—the user name for the OC4J instance. The user name is assigned at installation time.
- *<password>*—the password for the OC4J instance. The password is assigned at installation time.
- `ejbApp`—the name of the application.

- `default-web-site`—the Web site to which the application will be bound. This is usually `default-web-site`. To configure Web sites, see the `server.xml` file in `<OC4J_HOME>/j2ee/home/config`.

After deployment, this Web service's WSDL will be available at the following Web address. The values for *context-root* and *endpoint-address-uri* can be found in the `META-INF/oracle-webservices.xml` file.

`http://host:port/context-root/endpoint-address-uri`

5. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.
6. Generate the client-side code:
   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling a stub, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling a client for a J2EE Web service, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command generates stubs that can be used for a J2SE client:

```
java -jar wsa.jar -genProxy
                  -output build/src/client/
                  -wsdl http://localhost:8888/hello/HelloService?WSDL
                  -packageName oracle.demo.hello
```

   This command generates the client proxies and stores them in the directory `build/src/client`. The client application will use the stub to invoke operations on a remote service. For more information on the required and optional arguments to `genProxy`, see "genProxy" on page 17-30.
7. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

Ant Tasks for Generating a Web Service

The current release provides Ant tasks for Web services development. The following code samples show how the WebServicesAssembler commands in the preceding examples can be rewritten as Ant tasks.

For the `ejbAssemble` command, here is an example Ant task:

```
<oracle:ejbAssemble appName="ejbApp"
         targetNamespace="http://oracle.j2ee.ws/ejb/Hello"
```

```
          ear="dist/ejbApp.ear"
          output="build"
          typeNamespace="http://oracle.j2ee.ws/ejb/Hello/types"
          input dist/HelloServiceejb.jar
          ejbName HelloServiceBean
/>
```

For the `genProxy` command, here is an example Ant task:

```
<oracle:genProxy wsdl="http://localhost:8888/hello/HelloService?WSDL"
           output="build/src/client"
           packageName="oracle.demo.hello"
/>
```

Writing EJBs for Web Services

Writing EJB-based Web services using JAX-RPC involves writing an EJB that implements a service and providing an interface for it. The EJB should contain the business functions that OracleAS Web Services can invoke when a client makes a Web service request.

This section provides information on how to write an EJB Web service that returns a string, "`HELLO!! You just said:`*phrase*", where *phrase* is input from a client. The EJB Web service receives a client request with a single `String` parameter and generates a response that it returns to the Web service client.

Writing a J2EE 1.4-compliant EJB implementation for Web services consists of these tasks.

- Writing an EJB Service Endpoint Interface
- Writing an EJB

Writing an EJB Service Endpoint Interface

To use JAX-RPC to create a Web service with EJBs, you must write a public service endpoint interface to which the EJB must conform. The requirements for creating a service endpoint interface for a stateless session bean are summarized in Section 5.3.2.1 of the Enterprise Web Services 1.1 specification. The specification is available from the following Web address.

`http://www.jcp.org/en/jsr/detail?id=921`

The interface must extend `java.rmi.Remote`, and all methods must throw a `java.rmi.RemoteException`. You can use only Java primitives and classes that are JAX-RPC value types and nonstandard data types as parameters or return types for the EJB methods defined in the service endpoint interface.

Some examples of JAX-RPC value types are non-primitives such as `java.lang.String` or `java.lang.Double` and Java mappings of Multipurpose Internet Mail Extensions (MIME) types such as `java.awt.Image` or `javax.xml.transform.Source`. The nonstandard types are defined in "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and in Table 4–1 on page 4-6.

You can use custom Java data types in the service endpoint interface, but then you must also provide a serializer to process them. For more information on using custom data types and their serialization, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Example 7–1 Sample Service Endpoint Interface

```
package oracle.demo.ejb;

import java.rmi.Remote;
import java.rmi.RemoteException;
/**
 * This is an Enterprise Java Bean Service Endpoint Interface
 */
public interface HelloServiceInf extends java.rmi.Remote {
    /**
     * @param phrase java.lang.String
     * @return java.lang.String
     * @throws String The exception description.
     */
    java.lang.String sayHello(java.lang.String phrase)
          throws java.rmi.RemoteException;
}
```

Writing an EJB

Create an Enterprise Java Bean by implementing the business functions that you want the Web service to expose.

The `HelloServiceBean` described in this section is a sample session bean. The class defines a public method, `sayHello`, that returns `HELLO!! You just said:` *phrase*, where *phrase* was input from a client. In general, a Java bean for a Web service defines one or more public methods.

An Enterprise Java Bean, for the purposes of Web services, is any Java class that conforms to the following requirements:

- It must have a constructor that takes no arguments.
- All properties that you want to use must be exposed through accessors.

The EJB's parameters and return types must be JAX-RPC supported data types or nonstandard data types as described in "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide* and in Table 4–1 on page 4-6.

To comply with the JAX-RPC standard, all the methods in `HelloServiceBean` throw a `java.rmi.RemoteException`. They must also follow all the requirements of the version 2.1 EJB specification and Enterprise Web Services 1.1 specification.

Example 7–2 Sample HelloService Session Bean

```
package oracle.demo.ejb;

import java.rmi.Remote;
import java.rmi.RemoteException;
import java.util.Properties;
import javax.ejb.*;

/**
 * This is a Session Bean Class.
 */
public class HelloServiceBean implements SessionBean {
    public String sayHello(String phrase) {
        return "HELLO!! You just said :" + phrase;
    }
```

```
    public void setSessionContext(javax.ejb.SessionContext ctx)
            throws java.rmi.RemoteException {
    }

    public void ejbActivate() throws java.rmi.RemoteException {
    }

    public void ejbCreate()
            throws javax.ejb.CreateException,
                   java.rmi.RemoteException {
    }
    public void ejbPassivate() throws java.rmi.RemoteException {
    }

    public void ejbRemove() throws java.rmi.RemoteException {
    }
}
```

Packaging and Deploying Web Services that Expose EJBs

The packaging structure of Web services that expose EJBs is described in "Packaging for a Web Service Based on EJBs" on page 18-3.

For a detailed description of the deployment of EJBs, see the *Oracle Containers for J2EE Deployment Guide*.

Providing Transport-Level Security

You can use the `<ejb-transport-security-constraint>` and `<ejb-transport-login-config>` elements in the `oracle-werbservices.xml` deployment descriptor to configure transport-level security constraints for a version 2.1 or 3.0 EJB. These elements are described in "Securing EJB-Based Web Services at the Transport Level" on page 18-16.

For more information on providing transport-level security for EJBs, and how to write clients to access Web services secured on the transport level, see "Adding Transport-level Security for Web Services Based on EJBs" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.

Tool Support for Exposing EJBs as a Web Service

With Oracle JDeveloper, you can use modeling tools and wizards to create, modify, and deploy J2EE-compliant EJBs. The EJB wizards can be used to perform the following tasks.

- Create the Enterprise Bean class for several types of Enterprise JavaBeans, including stateless session beans.
- Generate the home interface needed to create an EJB object. The inclusion of the `ejbCreate()` method enables you to deploy the EJB to Oracle Applications Server immediately, without having to manually code the method.
- Enable a selection of home interface methods (and create a default method).
- Generate the remote interface.
- Enable a selection of remote interface methods.
- Deploy the EJB exposed as a Web service.

For more information on using JDeveloper to create EJBs and expose them as a Web service, see the JDeveloper on-line help.

Limitations

See "Assembling Web Services From EJBs" on page C-5.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building a J2EE client, see Chapter 13, "Assembling a J2EE Web Service Client".
- building a J2SE client, see Chapter 14, "Assembling a J2SE Web Service Client".
- using JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding transport-level security to Web services based on EJBs, see "Securing EJB-Based Web Services at the Transport Level" on page 18-16.

  See also "Adding Transport-level Security to a Web Service" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

8

Assembling Web Services with JMS Destinations

This chapter describes how to expose a JMS destination as a Web service. A JMS endpoint Web service exposes JMS destinations, either queues or topics, as document-literal style operations in the WSDL. The operation can be in either send or receive mode.

A JMS endpoint Web service can be considered to be a special case of the Java endpoint Web service. In a JMS endpoint Web service, the JMS endpoint implements Web service operations by sending and receiving JMS message objects.

> **Note:** There are differences between a Web service based on queues (or Oracle Streams Advanced Queuing (AQ)) in the database and a Web service based on a JMS destination. The AQ Web service is based on a configuration of queues that reside in the database. The JMS destination Web service is based on the configuration of a JMS provider in the middle tier. The JMS queues reside in a backend data source. This data source could be a database, a file-based system, or some other data repository.
>
> If you want to construct a Web service from a queue or an AQ in the database, see "Exposing an Oracle Streams AQ as a Web Service" on page 9-20.

Understanding JMS Endpoint Web Services

OracleAS Web Services enables you to create Web service endpoints that let you put messages on and take messages off JMS destinations. A JMS Web service endpoint is configured to transfer messages to and from a specific JMS destination or pair of destinations.

A JMS endpoint Web service can have the following operations.

- `send`—the XML payload (SOAP `body` element) is sent to the corresponding JMS destination. A send operation can be configured so that JMS message properties can be set on each sent message to indicate the JMS reply-to destination, priority, expiration, and so on.
- `receive`—a message is retrieved from the corresponding JMS destination, the content of the JMS message is used to create the SOAP response message body payload.
- both—a service can offer both operations.

A JMS endpoint Web service can be configured so that message-ID, correlation-ID, and reply-to-destination JMS message properties can be transmitted as SOAP headers. With this configuration, the message property headers and their types are explicitly declared on the generated WSDL and schema so that the Web service client can use them.

- If the destination is a JMS queue, then invoking the `send` operation means enqueue. Invoking the `receive` operation means dequeue.
- If the destination is a topic, then the `send` operation means publish and the `receive` operation means subscribe.

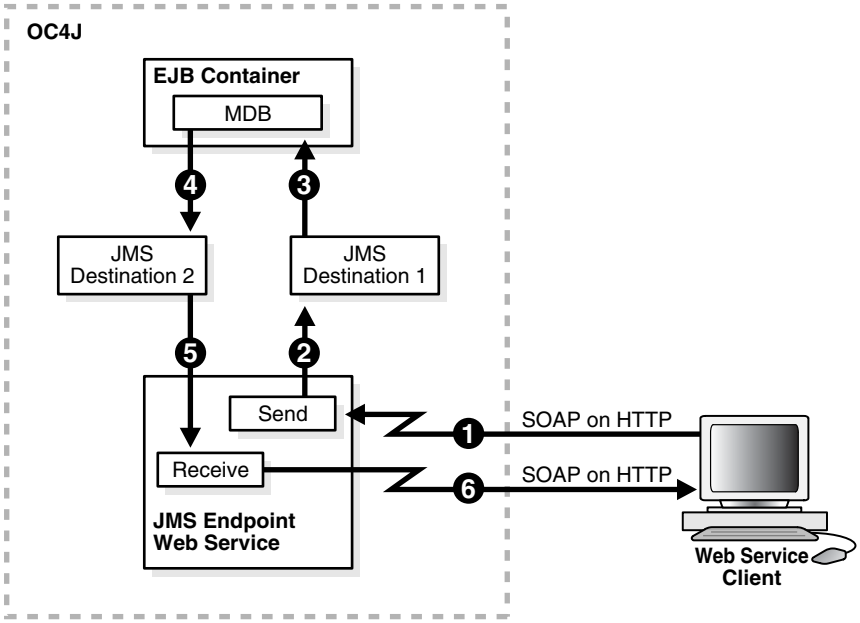
An individual JMS endpoint Web service can support just the `send` operation, just the `receive` operation, or both operations, as determined by the service developer.

JMS endpoint Web services use `javax.jms.ObjectMessage` as the JMS message type. As content, it can carry an instance of `javax.xml.soap.SOAPElement` or a `String` representation of an XML fragment.

The WSDL generated for a send JMS endpoint Web service follows the Web Service-Interoperability (WS-I) Basic Profile 1.0 and should be interoperable.

Figure 8–1 shows an MDB-based JMS endpoint Web service application that, from the JMS endpoint Web service's view, handles both the message `send` and the message `receive` operations. The figure also includes an MDB that is configured to listen to a JMS destination.

Figure 8–1 MDB-Based JMS Endpoint Web Service



The following steps describe how the MDB-based JMS endpoint Web service application illustrated in Figure 8–1 works.

1. A Web service client sends a SOAP request to invoke the `send` operation on the JMS endpoint Web service.
2. The JMS endpoint Web service processes the incoming message and directs it to a JMS destination, JMS `Destination 1`.
3. The EJB container invokes the MDB listening on JMS `Destination 1`.

4. After processing the message an MDB produces a new message on JMS `Destination 2`. Producing and consuming messages could involve one or more MDBs. For example, a single MDB could be listing on JMS `Destination 1` and the same MDB could also send the message to JMS `Destination 2`.
5. (Arrows 5 and 6) A Web service client sends a SOAP request to perform a `receive` operation on the JMS endpoint Web service to retrieve a message. The JMS endpoint Web service consumes a message from the JMS destination, encloses it in a SOAP response message, and passes the outgoing SOAP response message to the client.

How to Assemble a JMS Endpoint Web Service

The following steps describe how to assemble a JMS Endpoint Web service with the WebServicesAssembler tool.

1. Generate the Web service EAR file by running the WebServicesAssembler with the `jmsAssemble` command. The J2EE EAR file produced by this command includes the JMS endpoint Web service configuration information, including the WSDL and the generated `web.xml` file. For example:

```
java -jar wsa.jar -jmsAssemble
     -sendConnectionFactoryLocation jms/ws/mdb/theQueueConnectionFactory
     -sendQueueLocation jms/ws/mdb/theQueue
     -replyToConnectionFactoryLocation jms/ws/mdb/logQueueConnectionFactory
     -replyToQueueLocation jms/ws/mdb/logQueue
     -linkReceiveWithReplyTo true
     -targetNamespace http://oracle.j2ee.ws/jms-doc
     -typeNamespace http://oracle.j2ee.ws/jms-doc/types
     -serviceName JmsService
     -appName jms_service
     -context jms_service
     -input ./build/mdb_service.jar
     -uri JmsService
     -output ./dist
```

   For the `jmsAssemble` command you must specify as a minimum, either a `sendConnectionFactoryLocation` or `replyToConnectionFactoryLocation`. For more information on this command, see "jmsAssemble" on page 17-15.

   In this example, `jms/ws/mdb/theQueueConnectionFactory` is the JNDI name of the JMS connection factory used to produce connections to the JMS queue for the JMS `send` operation.

   - `jms/ws/mdb/theQueue`—the JNDI name of the JMS queue to which the `send` operation sends the SOAP message payload.
   - `jms/ws/mdb/logQueueConnectionFactory`—the JNDI name of the JMS connection factory to be used for the reply-to queue.
   - `jms/ws/mdb/logQueue`—the JNDI name of the JMS queue that will be set to each send message as the default reply-to destination. Because the `linkReceiveWithReplyTo` argument is enabled in this example, this reply-to destination is also used by the `receive` operation of the JMS endpoint Web service to retrieve messages.
2. Deploy all of the JMS destinations.
3. Deploy the service and bind the application.

Deploy the EAR file in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see Chapter 18, "Packaging and Deploying Web Services" and the *Oracle Containers for J2EE Deployment Guide*. The following is a sample deployment command:

```
java -jar <OC4J_HOME>/j2ee/home/admin_client.jar deployer:oc4j:localhost:port
<user> <password>
            -deploy
            -file dist/jms_service.ear
            -deploymentName jms_service
            -bindWebApp default-web-site
```

The following list describes the parameters in this code example.

- *<oc4jHome>*—The directory containing the OC4J installation.
- *<user>*—The user name for the OC4J instance. The user name is assigned at installation time.
- *<password>*—The password for the OC4J instance. The password is assigned at installation time.
- `default-web-site` —The Web site to which the application will be bound. This is usually `default-web-site`. To configure Web sites, see the `server.xml` file in *<OC4J_HOME>*`/j2ee/home/config`.

4. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.
5. Generate the client-side code.

   There is no difference between generating a client-side proxy from a JMS endpoint Web service WSDL and any other Web service WSDL. The JMS endpoint Web service WSDL is interoperable, in that it should be consumed by WS-I Basic Profile 1.0-compliant WSDL tools. For example, you can use a .NET WSDL tool to generate C# client stubs to communicate with an Oracle JMS endpoint Web service.

   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling client-side code for the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a service endpoint interface and a mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling client-side code, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command generates stubs that can be used for a J2SE client:

   ```
   java -jar wsa.jar -genProxy
                     -output build/src/client/
                     -wsdl http://localhost:8888/hello/JmsService?WSDL
                     -packageName oracle.demo.jms_service
   ```

   This command generates the client proxies and stores them in the directory `build/src/client`. The client application uses the stub to invoke operations on

a remote service. For more information on the required and optional arguments to `genProxy`, see "genProxy" on page 17-30.

6. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

Ant Tasks for Generating a Web Service

This release provides Ant tasks for Web service development. The following code sample shows how the `jmsAssemble` command can be rewritten as an Ant task.

```
<oracle:jmsAssemble
         linkReceiveWithReplyTo="true"
         targetNamespace="http://oracle.j2ee.ws/jms-doc"
         typeNamespace="http://oracle.j2ee.ws/jms-doc/types"
         serviceName="JmsService"
         appName="jms_service"
         context="jms_service"
         input="./build/mdb_service.jar"
         uri="JmsService"
         output="./dist"
         sendConnectionFactoryLocation="jms/ws/mdb/theQueueConnectionFactory"
         sendQueueLocation="jms/ws/mdb/theQueue"
         replyToConnectionFactoryLocation="jms/ws/mdb/logQueueConnectionFactory"
         replyToQueueLocation="jms/ws/mdb/logQueue"/>
```

Message Processing and Reply Messages

The JMS endpoint Web service processes an incoming SOAP message and places the payload (the `body` element of the SOAP message) on a JMS destination. This section covers details that a developer needs to know to consume and process the JMS messages that originate from a JMS endpoint Web service.

The JMS message content associated with a JMS endpoint Web service can be either an instance of `javax.xml.soap.SOAPElement` (which is also a subclass of `org.w3c.dom.Element`), or `java.lang.String` which is the string representation of the XML payload. The JMS endpoint Web service may set certain JMS message header values before it places the message on a JMS destination. Depending on the values of optional configuration arguments specified when the JMS endpoint Web service is assembled, the JMS endpoint Web service sets the following JMS message headers.

```
JMSType
JMSReplyTo
JMSExpiration
JMSPriority
JMSDeliveryMode
```

When the JMS endpoint Web service sets the `JMSReplyTo` header, it uses either the value specified with the `replyToTopicLocation` or the `replyToQueueLocation` (only one of these should be configured for any given JMS endpoint Web service). The value specified with the `replyToConnectionFactoryLocation` argument is set on

the message as a standard string property. The property name is `OC4J_REPLY_TO_FACTORY_NAME`.

Example 8–1 provides a code segment that shows where the `onMessage()` method gets the `reply-to` information for a message generated from a JMS endpoint Web service `send` operation:

Example 8–1 Getting Reply-To Information for a Message Generated by a Send Operation

```
...
public void onMessage(Message inMessage) {
    // Do some processing
    ObjectMessage msg = null;
    String  factoryName;
    Destination dest;
    Element  el;
    try {
      // Message should be of type objectMessage
      if (inMessage instanceof ObjectMessage) {
        // retrieve the object
        msg = (ObjectMessage) inMessage;
        el = (Element)msg.getObject();
        System.out.println("MessageBean2::onMessage() => Message received: " );
        ((XMLElement)el).print(System.out);
        processElement(el);
        factoryName = inMessage.getStringProperty("OC4J_REPLY_TO_FACTORY_NAME");
        dest = inMessage.getJMSReplyTo();
...
```

Limitations

See "Assembling Web Services with JMS Destinations" on page C-5.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building J2EE Web service clients, see Chapter 13, "Assembling a J2EE Web Service Client".
- building J2SE Web service clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

9

Developing Database Web Services

This chapter describes how you can develop Oracle Application Server Web Services that interact with an Oracle database. There are two ways in which OracleAS Web Services can interact with a database: call-in and call-out. Web service call-in refers to providing a Web service that provides access to a database resource. The Web service runs in an OC4J instance and accesses the database resource through JDBC.

Web services call-out refers to invoking an external Web service from inside the database. The invocation can be performed by PL/SQL, SQL, or Java code running in the database.

This chapter contains these sections.

Understanding Database Web Services

Web service technology enables application-to-application interaction over the Web—regardless of platform, language, or data formats. The key ingredients, including XML, SOAP, WSDL, UDDI, WS-Security, and WS-Reliability have been adopted across the entire software industry. Web service technology usually refers to services implemented and deployed in middle-tier application servers. However, in heterogeneous and disconnected environments, there is an increasing need to access stored procedures, data and metadata, through Web service interfaces. Database Web service technology is a database approach to Web services. It works in two directions:

- accessing database resources as a Web service (database call-in)
- consuming external Web services from the database itself (database call-out)

Database Call-In

Turning the Oracle database into a Web service provider leverages your investment in Java stored procedures, PL/SQL packages, Advanced Queues, pre-defined SQL queries and DML. Client applications can query and retrieve data from Oracle databases and invoke stored procedures using standard Web service protocols. There is no dependency on Oracle-specific database connectivity protocols. Applications can employ any cached OC4J connection. This approach is very beneficial in heterogeneous, distributed, and non-connected environments.

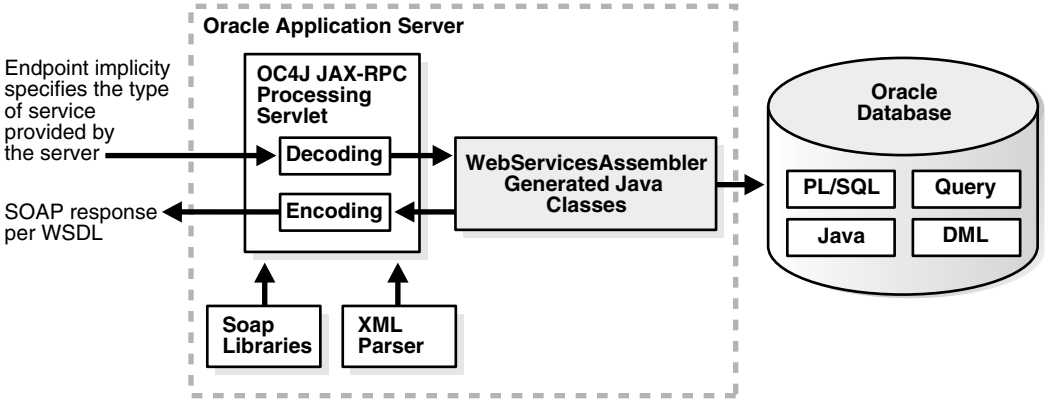
Since database Web services are a part of OracleAS Web Services, they can participate in a consistent and uniform development and deployment environment. Messages exchanged between the database and the Web service can take advantage of all of the management features provided by OracleAS Web Services, such as security, reliability, auditing and logging.

Figure 9–1 illustrates Web service call-in. The following steps describe the process.

1. A request for a type of database service arrives at the application server. The service endpoint implicitly specifies the type of service requested.
2. The OC4J JAX-RPC processing servlet references the SOAP libraries and XML parser to decode the request.
3. The servlet passes the request to the WebServicesAssembler-generated classes that correspond to the exposed database operations. WebServicesAssembler generates these classes by silently calling Oracle JPublisher. The generated classes can represent PL/SQL packages, queries, DML, AQ Streams, or Java classes in the database.
4. The database passes the response to the OC4J JAX-RPC processing servlet, which references the SOAP libraries and XML parser to encode it.
5. A SOAP response formed in accordance with the WSDL is returned to the client.

See "Developing Web Services that Expose Database Resources" on page 9-6 for more information on exposing PL/SQL packages, SQL queries, DML statements, Oracle AQ Streams, or server-side Java classes database operations as a Web service.

Figure 9–1 Web Service Calling-In to the Database



Database Call Out

You can extend a relational database's storage, indexing, and searching capabilities to include Web Services. By calling a Web service, the database can track, aggregate, refresh, and query dynamic data produced on-demand, such as stock prices, currency exchange rates, and weather information.

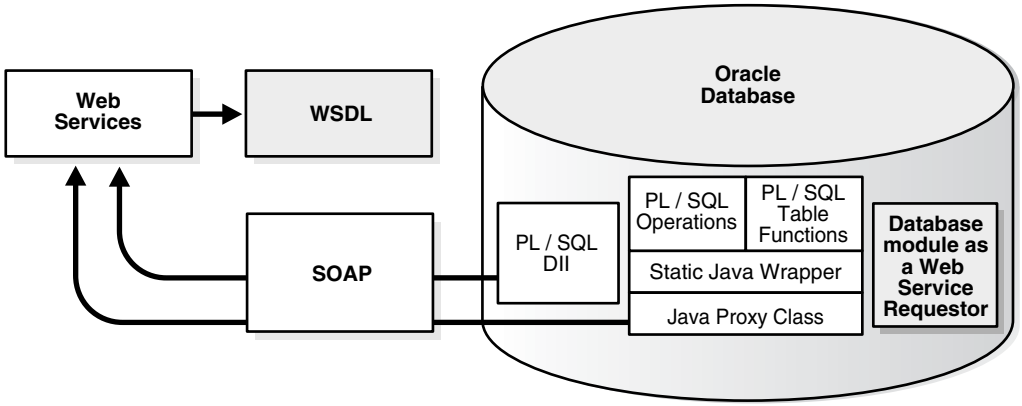
An example of using the database as a service consumer would be to call an external Web service from a predefined database job to obtain inventory information from multiple suppliers, then update your local inventory database. Another example is that of a Web Crawler: a database job can be scheduled to collate product and price information from a number of sources.

Figure 9–2 illustrates database call out.

- SQL and PL/SQL call specs—Invoke a Web service through a user-defined function call (generated through Oracle JPublisher) either directly within a SQL statement or view or through a variable.
- Dynamic Web service invocation using the `UTL_DBWS` PL/SQL package. A `Call` object can be dynamically created based on a WSDL and subsequently, Web services operations can be invoked. This is described in the *Oracle Database PL/SQL Packages and Types Reference*.
- Pure Java static proxy class—Use Oracle JPublisher to pre-generate a client proxy class. which uses JAX-RPC. This method simplifies the Web service invocation as the location of the service is already known without needing to look up the service in the UDDI registry. The client proxy class does all of the work to construct the SOAP request, including marshalling and unmarshalling parameters.
- Pure Java using DII (dynamic invocation interface) over JAX-RPC—Dynamic invocation provides the ability to construct the SOAP request and access the service without the client proxy.

Which method to use depends on whether you want to execute from SQL or PL/SQL, from Java classes, or whether the service is known ahead of time (static invocation) or only at runtime (DII). See "Developing a Web Service Client in the Database" on page 9-32 for more information about the support OracleAS Web Services offers for PL/SQL and Java call-outs from the database.

Figure 9–2 Calling Web Services From Within the Database



Type Mapping Between SQL and XML

The following sections describe the type mappings between SQL and XML for call-ins and call-outs when the Web service is known ahead of time (static invocation).

- SQL to XML Type Mappings for Web Service Call-Ins
- XML to SQL Type Mapping for Web Service Call-Outs

When the Web service is known at runtime you can use only the Dynamic Invocation Interface (DII) or the `UTL_DBWS` PL/SQL package. For more information on using the JAX-RPC DII, see the API at the following Web address.

`http://java.sun.com/j2ee/1.4/docs/#api`

For more information on using the `UTL_DBWS` package, see the *Oracle Database PL/SQL Packages and Types Reference*.

SQL to XML Type Mappings for Web Service Call-Ins

In a database Web service call-in, a SQL operation, such as a PL/SQL stored procedure or a SQL statement, is mapped into one or more Web service operations. The parameters to the SQL operation are mapped from SQL types into XML types.

> **Note:** The reason there may be more than one operation is because OracleAS Web Services may be providing additional data representation choices for the SQL values in XML, such as different representations of SQL result sets.

Table 9–1 illustrates the SQL to XML mappings for Web service call-ins. The first column lists the SQL types. The second column of the table, **XML Type (Literal)**, shows SQL-to-XML type mappings for the default `literal` value of the `use` attribute. The third column, **XML Type (Encoded)**, shows the mappings for the `encoded` value of the `use` attribute. The `literal` and `encoded` values refer to the rules for encoding the body of a SOAP message. See "Literal and Encoded Uses" on page 4-2 for more information on these rules.

Table 9–1 SQL-to-XML Type Mappings for Web Services Call-Ins

SQL Type	XML Type (Literal)	XML Type (Encoded)
INT	int	int
INTEGER	int	int
FLOAT	double	double
NUMBER	decimal	decimal
VARCHAR2	string	string
DATE	dateTime	dateTime
TIMESTAMP	dateTime	dateTime
BLOB	byte[]	byte[]
CLOB	String	String
LONG	String	String
RAW	byte[]	byte[]
SQL object	complexType	complexType
PL/SQL record	complexType	complexType
Primitive PL/SQL indexby table	Array	Array
SQL table	complexType	complexType
PL/SQL indexby table	complexType	complexType
PL/SQL Boolean	boolean	boolean
REF CURSOR (*name*Beans)	Array	Array
REF CURSOR (*name*XML)	any	text_xml
REF CURSOR (*name*XMLRowSet)	swaRef	text_xml

Table 9–1 (Cont.) SQL-to-XML Type Mappings for Web Services Call-Ins

SQL Type	XML Type (Literal)	XML Type (Encoded)
SYS.XMLTYPE	any	text_xml

A query or a PL/SQL function returning `REF CURSOR` will be mapped into three methods, *name*`Beans`, *name*`XMLRowSet`, and *name*`XML`, where *name* is the name of the query or the PL/SQL function.

- *name*`Beans`—this method returns an array, where each element is an instance of an XSD complex type that represents one row in the cursor. A complex type subelement corresponds to a column in that row.
- *name*`XMLRowSet`—this method returns a `swaRef` or `text_xml` response that contains an `OracleWebRowSet` instance in XML format. "Working with MIME Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on the `swaRef` MIME format
- *name*`XML`—this method returns an XML `any` or `text_xml` response that contains an Oracle `XDB` row set.

"Exposing a SQL Query or DML Statement as a Web Service" on page 9-14 shows examples of returning a result set which is similar to `REF CURSOR`.

Both `OUT` and `IN OUT` PL/SQL parameters are mapped to `IN OUT` parameters in the WSDL file. See "Mapping PL/SQL IN and IN OUT Parameters to XML IN OUT Parameters" on page 9-12 for an example of how parameters are generated into the WSDL and then accessed from client code.

Note that Table 9–1 provides two different mappings: one for literal and another for encoded `use`. The default mapping is literal. From a database Web service's perspective, there is no special reason why encoded should be used. The mapping for encoded is provided in case you encounter scenarios which call for the encoded `use` setting. All of the descriptions in this chapter assume that you will be using the literal `use` setting unless otherwise specified.

Changing the SQL to XML Mapping for Numeric Types

Table 9–1 defines SQL to XML type mappings used for call-ins. The mappings for the numeric types is determined by how Oracle JPublisher maps SQL types to Java types. By default, the WebServicesAssembler tool uses the Oracle JPublisher option `-numbertypes=objectjdbc`. As a result, the XML types corresponding to the SQL numeric types are all declared nillable in the generated WSDL file. To change the Oracle JPublisher mappings, and hence change the XML types, you can use the WebServicesAssembler `jpubProp` argument. For example, if you specify the following argument in the database WebServicesAssembler Ant task, then the XML types generated for SQL numeric types will not be declared nillable.

```
jpubProp="numbertypes=jdbc"
```

On the other hand, if you specify either `oracle` or `bigdecimal` as the target of the `numbertypes` option, then the XML types generated for SQL numeric types will all be `decimal` and nillable.

XML to SQL Type Mapping for Web Service Call-Outs

In database Web services call-outs, XML types are mapped into SQL types. Table 9–2 lists the XML-to-SQL type mappings used in call-outs.

Table 9–2 XML-to-SQL Type Mappings for Web Services Call-Outs

XML Type	SQL Type
int	NUMBER
float	NUMBER
double	NUMBER
decimal	NUMBER
dateTime	DATE
String	VARCHAR2
byte[]	RAW
complexType	SQL OBJECT
Array	SQL TABLE
text_xml	XMLType

Developing Web Services that Expose Database Resources

This section describes how to develop Web services implemented as PL/SQL stored procedures, SQL statements, Oracle Streams AQ queues, and server-side Java classes.

How to Use Life Cycle for Web Service Call-in

Creating a database Web service call-in application is a bottom up process. In many cases, you will want to reuse existing database applications (such as PL/SQL packages or Java applications) or operational scripts (such as SQL query, DML, or AQ). You can also populate the database with the resources to be exposed as a Web service. Web service call-ins typically follow these steps:

1. Determine which database resources to expose and make them available.

   For example, you can provide the resources in any of the following ways.

   - load the PL/SQL package into the database
   - create the schema used by SQL query or DML statement Web service
   - load the Java class into the database, for a database server-side Java Web service

2. Run the WebServicesAssembler tool to assemble the Web service, based on the specified resources.

   Note that you could also use JDeveloper to assemble the Web service.

3. If the Web service assembly generates a PL/SQL wrapper, load it into the database.

PL/SQL Web service assembly may generate a wrapper if a PL/SQL record or `INDEX BY` table type is included in the PL/SQL package. You must load the wrapper into the database. Server-side Java call-in assembly always generates a PL/SQL wrapper. WebServicesAssembler will load the wrapper automatically if the `sysUser` argument is set. For more information, see sysUser on page 17-50.

Note that you could also use JDeveloper to load the PL/SQL wrapper into the database.

4. Configure the OC4J data sources to ensure that the Oracle JPublisher-generated Java classes that constitute the Web service implementation can connect to the database and the resource it is exposing.

   Add a data source entry in the J2EE data source file, so that the Web service application can connect to the database.

5. Deploy the Web service application into a running instance of OC4J.

6. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.

7. Use the WebServicesAssembler tool to generate the Web services client proxy and incorporate it into your client application.

8. Invoke the Web service using the client proxy.

WebServicesAssembler Support for Web Service Call-in

For all Web service call-in types, the WebServicesAssembler tool requires the following arguments.

- appName—the application name
- dataSource—the data source JNDI name; used at runtime
- dbConnection—the database connection URL; used at code generation time
- dbUser—the database user and password; used at code generation time

The `appName` argument specifies the Web service application name. The `dataSource` argument defines the data source's JNDI location for the database being accessed. At runtime, the Web service code accesses the database through that data source.

The WebServicesAssembler tool uses the `dbConnection` and `dbUser` arguments to define the connection to the database during Web service creation. The values of these arguments are used at code generation time, not at runtime. The `dbConnection` argument is used to access the information on the resource that is to be exposed. For example, it accesses information about the PL/SQL package, the schema, or the query.

The database used at Web service creation time and the one used at runtime do not have to be the same database. However, both should include the schema that contains the database resources being exposed.

At runtime, database Web services obtain the database connection from the data source. The database Web service deals with connection loss by reconnecting to the database. When the connection is in an invalid state, the Web service will attempt to reestablish the connection. If the Web service fails to re-connect, it will return a fault. The next time the client invokes the Web service, the Web service will attempt to connect to the database. Therefore, it is possible for the Web service to return a fault at one moment, but succeed later, due to connection failure handling.

The following arguments are optional and can be used in all Web service call-in scenarios.

- context—root context for the web application
- debug—displays detailed diagnostic messages
- ear—name and location of the generated EAR
- jpubProp—specifies Oracle JPublisher options to fine-tune Oracle JPublisher code generation
- output—location for storing generated files
- portName—the name of the port in the generated WSDL
- serviceName—local part of the service name in the generated WSDL
- style—the `style` part of the message format used in the generated WSDL
- uri—URI to use for the Web service in the deployment descriptors
- use—the `use` part of the message format used in the generated WSDL

The common prerequisite for all call-in types is that the database is populated with the resource to be exposed. The WebServicesAssembler employs Oracle JPublisher to generate Java code to access database resources. The `jpubProp` argument, which can appear more than once on the command line or in an Ant task, lets you pass options to Oracle JPublisher. Refer to the *Oracle Database JPublisher User's Guide* for the list of options and for information on how Oracle JPublisher maps PL/SQL, SQL types, SQL statements, and server-side Java into client-side Java wrappers.

Exposing PL/SQL Packages as Web Services

Use the `plsqlAssemble` command to assemble Web services from a PL/SQL stored procedure. In the generated Web service, each Web service operation corresponds to a PL/SQL stored procedure.

Prerequisites

Before you begin, provide the following files and information.

- The PL/SQL package that you want to expose as a Web service

  See "Sample PL/SQL Package" on page 9-11 for the stored procedure that is used in this example.

- A name for the Web service application
- A JNDI location for the JDBC data source
- The JDBC database connection URL, and the username and password

How to Assemble a Web Service from a PL/SQL Package

The following steps describe how to assemble a Web service for the PL/SQL package `echo_plsql`.

1. Provide the PL/SQL package and the information described in the Prerequisites section as input to the WebServicesAssembler `plsqlAssemble` command.

```
java -jar wsa.jar
    -plsqlAssemble
    -appName Echo
    -sql echo_plsql
    -dataSource jdbc/OracleManagedDS
```

```
-dbConnection jdbc:oracle:thin:@stacd15:1521:lsqlj
-dbUser scott/tiger
-style rpc
-use encoded
```

The arguments that can be used with the `plsqlAssemble` command are described in "plsqlAssemble" on page 17-16.

By default, WebServicesAssembler generates services using document-wrapped style. However, JAX-RPC clients that use document-wrapped style do not support `IN OUT` parameters directly. Instead, WebServicesAssembler packages `IN` and `IN OUT` parameters separately. Since the PL/SQL package used in this example contains `IN OUT` parameters, the `plsqlAssemble` command includes the `-style rpc` argument. For more information on parameters and different document styles, see "Mapping PL/SQL IN and IN OUT Parameters to XML IN OUT Parameters" on page 9-12.

The command generates a Web service application, `EchoPlsql.ear`, and optionally, the following PL/SQL scripts.

- `Echo_plsql_wrapper.sql`—the PL/SQL wrapper generated to support PL/SQL `record` and `INDEX BY` table.
- `Echo_plsql_dropper.sql`—the PL/SQL script to tear down the types and packages created by the wrapper script.

2. Install any PL/SQL wrappers created during Web service generation into the database.

   Not all PL/SQL Web services assembly generates PL/SQL wrappers. If it does, you must load them into the appropriate user schema in the database before running the Web service.

   The wrappers can be loaded automatically or manually. To load the wrappers automatically, add the following line to the `plsqlAssemble` command:

   `-jpubProp plsqload` (for the command line), or

   `jpubprop="plsqlload"` (for an Ant task)

   To manually load the wrapper package after Web service assembly, use SQL*PLUS. The following command line provides a sample SQL*PLUS command to load a wrapper package.

   ```
   SQL>@Echo_plsql_wrapper.sql
   ```

3. Deploy the service into a running instance of OC4J and bind the application.

   The data source referenced by the `-dataSource` argument in Step 1 must be set up in this OC4J instance.

   The following command lines provide sample deployment and bind commands.

   ```
   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   welcome -deploy -file dist/echo.ear -deploymentName echo

   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   welcome -bindWebApp plsql plsql-web default-web-site /plsql
   ```

   In this example, <*J2EE_HOME*> is the directory where J2EE is installed.

   For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.

4. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.

5. Generate the client-side code.

   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. See Chapter 14, "Assembling a J2SE Web Service Client" for more information on generating and assembling client-side code for the J2SE environment.
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. See Chapter 13, "Assembling a J2EE Web Service Client" for more information on generating and assembling client-side code.

   For example, the following command uses the `genProxy` command to generate a J2SE client in the `build/classes/client` directory.

```
% java -jar wsa.jar -genProxy
                    -wsdl http://locahost:8888/plsql/echo?WSDL
                    -output build/src/client
                    -mappingFileName ./mapping.xml
                    -packageName oracle.demo.db.plsql.stub
                    -unwrapParameters true
```

6. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

   The following command line provides sample compile and run commands.

```
 % javac -classpath path:
         <ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
         :<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar EchoClient.java

% java -classpath path:
       <ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
       <ORACLE_HOME>/webservices/lib/jaxrpc-api.jar:
       <J2EE_HOME>/lib/jax-qname-namespace.jar:
       <J2EE_HOME>/lib/activation.jar:
       <J2EE_HOME>/lib/mail.jar:
       <J2EE_HOME>/lib/http_client.jar:
       <ORACLE_HOME>/lib/xmlparserv2.jar EchoClient
```

   In this example, *<J2EE_HOME>* is the directory where J2EE is installed, *<ORACLE_HOME>* is the directory where OracleAS Web Services is installed.

Ant Tasks for Generating a Web Service

This release provides Ant tasks for Web services development. The following example shows how the WebServicesAssembler `plsqlAssemble` command can be rewritten as an Ant task.

```
<oracle:plsqlAssemble
    dbUser="scott/tiger"
    sql="echo_plsql"
    dbConnection="jdbc:oracle:thin:@stacd15:1521:1sqlj"
    dataSource="jdbc/OracleManagedDS"
    appName="EchoPlsql"
    style="rpc"
    use="encoded"
/>
```

Sample PL/SQL Package

Example 9–1 illustrates a PL/SQL package in the database that can be exposed as a Web service. The package contains procedures and functions that exercise various SQL and PL/SQL data types.

Example 9–1 Sample PL/SQL Package

```
create or replace type address as object(
     street varchar2(30), city varchar2(30), state varchar2(2), zip varchar2(5));
create or replace type employee as object (eid int, efirstname varchar(30),
     elastname varchar(30), addr address, salary float);
create table employees (eid int, emp employee);
create table employee_espp (eid int, status int);
create table employee_accounts (eid int, accounts sys.xmltype);
create table employee_biodata (eid int, biodata CLOB);
create table employee_image (eid int, image BLOB);
create table employee_hiredate(eid int, hiredate TIMESTAMP);

create or replace package echo_plsql as
procedure set_object (emp IN employee);
function get_object1(id IN int) return employee;
function get_object2(id IN int) return address;
function hold_varchar(id IN int, firstname OUT varchar2, lastname OUT varchar2)
return float;
procedure set_boolean(id IN int , status IN boolean);
function get_boolean(id IN int) return boolean;
procedure hold_float_inout(id IN int, newsalary IN OUT float);
procedure clear_object (id IN int);
procedure set_clob (id int, biodata IN CLOB);
function get_clob(id IN int) return CLOB;
procedure set_blob(id int, image IN BLOB);
function get_blob(id IN int) return BLOB;
procedure set_xmltype(id IN number, accounts sys.xmltype);
function get_xmltype(id IN number) return sys.xmltype;
procedure set_date(id IN int, hiredate IN TIMESTAMP);
function get_date(id IN int) return TIMESTAMP;
TYPE rec is RECORD (emp_id int, manager_id int);
TYPE index_tbl is TABLE OF rec INDEX BY BINARY_INTEGER;
function echo_rec(mrec rec) return rec;
function echo_index_tbl(mtbl index_tbl) return index_tbl;
end echo_plsql;
```

Mapping Between PL/SQL Functions and Web Service Operations

PL/SQL functions or procedures are mapped into Web service operations, often with adjusted names. Typically, the underscore in a PL/SQL name is removed and the letter following the underscore is capitalized. For example, notice the PL/SQL function `echo_index_tbl` in Example 9–1. This function is mapped into the Web service operation `echoIndexTbl`. The WSDL fragment in Example 9–2 shows how the PL/SQL function `echo_index_tbl` is expressed as the `echoIndexTbl` Web service operation.

Example 9–2 WSDL Fragment, Illustrating the Mapping of a PL/SQL Function

```
<operation name="echoIndexTbl" parameterOrder="EchobaseIndexTblBase_1">
<input message="tns:Echo_echoIndexTbl"/>
<output message="tns:Echo_echoIndexTblResponse"/>
</operation>
```

Mapping PL/SQL IN and IN OUT Parameters to XML IN OUT Parameters

The PL/SQL parameters `OUT` and `IN OUT` in Example 9–1 on page 9-11 are represented as XML `IN OUT` parameters, as shown by the holder parameters of `holdVarchar`. The entries in the WSDL fragment in Example 9–3 illustrate the `holdVarchar` operation. The second and third parameters appear in both the input and output messages, which indicates that both parameters are IN OUT parameters.

Example 9–3 WSDL Fragment, Illustrating IN OUT Parameters

```
<operation name="holdVarchar"
   parameterOrder="Integer_1 String_2 String_3">
  <input message="tns:Echo_holdVarchar"/>
  <output message="tns:Echo_holdVarcharResponse"/>
</operation>
<message name="Echo_holdVarchar">
<part name="Integer_1" type="xsd:int"/>
<part name="String_2" type="xsd:string"/>
<part name="String_3" type="xsd:string"/>
</message>
<message name="Echo_holdVarcharResponse">
<part name="result" type="ns1:double"/>
<part name="String_2" type="xsd:string"/>
<part name="String_3" type="xsd:string"/>
</message>
```

To access the `IN OUT` parameters in JAX-RPC client code, you must use JAX-RPC holders. For example, the code in Example 9–4 retrieves the returned values as `firstName.value` and `lastName.value`, where `firstName` and `lastName` are both String holders. The actual values in the holders are accessed by the member `value`, as shown in the `println` statement.

Example 9–4 Accessing IN OUT Parameters in Client Code by Using JAX-RPC Holders

```
System.out.println("holdVarchar");
StringHolder firstName = new StringHolder("Tom");
StringHolder lastName = new StringHolder("Gordon");
System.out.println("Holder returned:  empid="
+ ci.holdVarchar(id, firstName, lastName)
+ ", name="
+ firstName.value
+ "."
+ lastName.value);
```

Note that the `plsqlAssemble` command line specified `-style rpc`. The RPC style supports holders. The default document-wrapped style does not support holders.

If the Web service had been created with the default document-wrapped style, then a different `holdVarchar` signature would have been generated. The `OUT` arguments would be captured as attributes on the return value.

The following WSDL segment shows the `holdVarchar` operation in the document-wrapped style. In the return type, `EchoUser_holdVarchar_Out`, the attributes `lastnameOut` and `firstnameOut` record the `OUT` value of the PL/SQL parameters `firstname` and `lastname`.

Example 9–5 WSDL Fragment, Illustrating IN OUT Parameters Handled in Document-Wrapped Style

```
<operation name="holdVarchar" parameterOrder="Integer_1">
            <input message="tns:Echo_holdVarchar"/>
            <output message="tns:Echo_holdVarcharResponse"/>
 </operation>

<message name="Echo_holdVarchar">
  <part name="Integer_1" type="xsd:int"/>
</message>
<message name="Echo_holdVarcharResponse">
  <part name="result" type="tns:Echo_holdVarchar_Out"/>
</message>

<complexType name="Echo_holdVarchar_Out">
     <sequence>
         <element name="return" type="double" nillable="true"/>
        <element name="lastnameOut" type="string" nillable="true"/>
         <element name="firstnameOut" type="string" nillable="true"/>
     </sequence>
</complexType>
```

Mapping SQL XMLType to XML any

The SQL `XMLType` in Example 9–1 on page 9-11 is mapped into the XML `any` type. The `getXmltype` operation in the WSDL fragment in Example 9–6 illustrates this mapping.

Example 9–6 WSDL Fragment, Illustrating the Mapping of SQL XMLType into text_xml

```
<message name="Echo_getXmltypeResponse">
<part name="result" type="ns2:any"/>
</message>
<operation name="getXmltype" parameterOrder="BigDecimal_1">
<input message="tns:Echo_getXmltype"/>
<output message="tns:Echo_getXmltypeResponse"/>
</operation>
```

WebServicesAssembler generates a proxy that maps XML `any` to the Java type `org.w3c.org.dom.Element`. Therefore, a Java client accesses a SQL `XMLType` instance as an `Element` instance.

Exposing a SQL Query or DML Statement as a Web Service

Use the `sqlAssemble` command to generate Web services from a SQL statement. The statement can include SQL queries and DML (Data Manipulation Language) statements.

Unlike PL/SQL Web services generation, SQL statement assembly does not generate PL/SQL wrappers. PL/SQL wrappers are generated only to handle PL/SQL `record` or `INDEX BY` table types. These types cannot be used in a SQL statement.

Prerequisites

Before you begin, provide the following files and information.

- The SQL statements or queries. Example 9–7, "Sample SQL Statements" on page 9-16 illustrates the SQL statements used in the following example.

  Multiple `sqlstatement` arguments can be specified on the command line or Ant task. For information on the format of the `sqlstatement` argument, see "sqlstatement" on page 17-49.
- A name for the Web service application.
- The JNDI location of the JDBC data source. This information is used at runtime.
- The JDBC database connection URL. This information is used at compile time.
- The name and password of the schema which the query or statement is based on. This information is used at compile time.

How to Assemble a Web Service from a SQL Statement or Query

The following steps use the `sqlAssemble` command to assemble a Web service for the queries and statements on the SCOTT schema.

1. Provide the SQL statements or query, the name and password for the database that they are based on, and the other information described in the Prerequisites section as input to the WebServicesAssembler `sqlAssemble` command.

   For example, the following command generates the Web service application `query.ear`.

   ```
   java -jar wsa.jar
      -sqlAssemble
      -appName query
      -dataSource jdbc/OracleManagedDS
      -sqlstatement "getEmpCount=select ename, sal from emp where
                        sal>:{mysal NUMBER}"
      -sqlstatement "getEmpBySal=select ename, sal from emp where
                        sal>:{mysal NUMBER}"
      -sqlstatement "updateEmp=update emp SET sal=sal+500 where
                        ename=:{myname VARCHAR}"
      -dbConnection jdbc:oracle:thin:@stacd15:1521:lsqlj
      -dbUser scott/tiger
   ```

2. Deploy the service into a running instance of OC4J and bind the application.

   The data source referenced in the `-dataSource` argument must have been set up for this OC4J instance.

   The following command lines provide sample deployment and bind commands.

   ```
   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   welcome -deploy -file dist/query.ear -deploymentName query
   ```

```
% java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
welcome -bindWebApp plsql plsql-web default-web-site /query
```

In these sample command lines, *<J2EE_HOME>* is the directory where J2EE is installed.

For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.

3. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.
4. Generate the client-side code.
   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling client-side code for the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling client-side code, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command uses `genProxy` to generate code for a J2SE client.

```
% java -jar wsa.jar -genProxy
                    -wsdl http://locahost:8888/query/query?WSDL
                    -output build/src/client
                    -mappingFileName ./mapping.xml
                    -packageName oracle.demo.db.query.stub
                    -unwrapParameters true
```

   The command generates the client in the `build/src/client` directory.
5. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

   The following command lines provide sample compile and run commands.

```
% javac -classpath path:
     <ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
     :<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar QueryClient.java

% java -classpath path
     <ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
     <ORACLE_HOME>/webservices/lib/jaxrpc-api.jar:
     <J2EE_HOME>/lib/jax-qname-namespace.jar:
```

```
        <J2EE_HOME>/lib/activation.jar:
        <J2EE_HOME>/lib/mail.jar:
        <J2EE_HOME>/lib/http_client.jar:
        <ORACLE_HOME>/webservices/lib/commons-logging.jar:
        <ORACLE_HOME>/lib/xmlparserv2.jar QueryClient
```

In this example, *<J2EE_HOME>* is the directory where J2EE is installed; *<ORACLE_HOME>* is the directory where the OC4J is installed.

Ant Tasks for Assembling a Web Service from SQL Queries or DML Statements

The current release provides Ant tasks for Web services development. The following example shows how the WebServicesAssembler `sqlAssemble` command can be rewritten as an Ant task.

```
<oracle:sqlAssemble
        appName="query"
        dataSource="jdbc/OracleManagedDS"
        dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
        dbUser="scott/tiger">
        <sqlstatement="getEmpCount=select ename, sal from emp where sal>:{mysal
NUMBER}"/>
        <sqlstatement="getEmpBySal=select ename, sal from emp where sal>:{mysal
NUMBER}"/>
        <sqlstatement="updateEmp=update emp SET sal=sal+500 where  ename=:{myname
VARCHAR}"/>
/>
```

Sample SQL Statements

Example 9–7 illustrates the SQL statements that are exposed as a Web service.

Example 9–7 Sample SQL Statements

```
getEmpCount=select ename, sal from emp where sal>:{mysal NUMBER}
getEmpBySal=select ename, sal from emp where sal>:{mysal NUMBER}
updateEmp=update emp SET sal=sal+500 where  ename=:{myname VARCHAR}
```

Mapping SQL Queries to Service Operations

A SQL query, when exposed as a Web service, is mapped to three service operations. For example, the `getEmpBySal` query in Example 9–7 generates these service operations.

- `getEmpBySal`**`Beans`**—returns an array. The array element is an object type with attributes corresponding to the columns in the row of the query result.
- `getEmpBySal`**`XMLRowSet`**—returns an XML document with the query result in the `WebRowSet` format.
- `getEmpBySal`**`XML`**—returns an XML document with the query result in Oracle `XDB` rowset format.

Providing three operations from one query is a convenience. The return values differ only in format. Note the naming convention is to attach `Beans`, `XMLRowSet`, and `XML` to the original query name.

The WSDL fragment in Example 9–8 describes the return types of the three operations in the WSDL file.

Example 9–8 WSDL Fragment, Illustrating Service Operations for a SQL Query

```
<complexType name="getEmpBySalBeansResponse">
<sequence>
<element name="result" type="tns:Query_getEmpBySalRowUser" nillable="true"
     minOccurs="0" maxOccurs="unbounded"/>
</sequence>
</complexType>
<complexType name="Query_getEmpBySalRowUser">
<sequence>
<element name="ename" type="string" nillable="true"/>
<element name="sal" type="decimal" nillable="true"/>
</sequence>
</complexType>

<complexType name="getEmpBySalXMLRowSetResponse">
<sequence>
<element name="result" type="ns1:swaRef" nillable="true"/>
</sequence>
</complexType>

<complexType name="getEmpBySalXMLResponse">
<sequence>
<element name="result" type="xsd:any" nillable="true"/>
</sequence>
</complexType>
```

Two of the methods, `getEmpBySalXMLRowSetResponse` and `getEmpBySalXMLResponse`, have parameters of `swaRef` type. For this type, the assembler generates `javax.xml.soap.AttachmentPart` in the client proxy. Example 9–9 illustrates the client code to access the returned query result.

Example 9–9 Accessing Returned Query Results from a swaRef Type in Client Code

```
import oracle.jdbc.pool.OracleDataSource;
import oracle.jdbc.rowset.OracleWebRowSet;
import javax.xml.soap.AttachmentPart;
import org.w3c.org.Element;
import javax.xml.transform.dom.*;
import java.io.*;
   ...

/* Access the query result as Oracle XDB RowSet */
Element element = eme.getEmpBySalXML(new BigDecimal(500));
DOMSource doms = new javax.xml.transform.doc.DOMSource(element);
buf = new jav.io.ByteArrayOutputStream();
StreamResult streamr = new StreamResult(buf);
trnas.transform(doms, streamr);
System.out.println(buf, toString());


/* Access the query result as Oracle WebRowSet */
ap = eme.getEmpBySalXMLRowSet(new BigDecimal(500));
source = (Source) ap.getContent();
trans = TransformerFactory.newInstance().newTransformer();
buf = new ByteArrayOutputStream();
streamr = new StreamResult(buf);
trans.transform(source, streamr);
InputStream istream = new ByteArrayInputStream(buf.toString().getBytes());
OracleWebRowSet rowset = new OracleWebRowSet();
System.setProperty("http.proxyHost", "www-proxy.us.oracle.com");
```

```
System.setProperty("http.proxyPort", "80");
         System.setProperty("javax.xml.parsers.DocumentBuilderFactory",
"oracle.xml.jaxp.JXDocumentBuilderFactory");
rowset.readXml(new InputStreamReader(istream));
rowset.writeXml(new PrintWriter(System.out));
```

The code in Example 9–9 emits the query result in two formats: Oracle XDB row set (`ROWSET`) and Oracle Web row set (`OracleWebRowSet`). Example 9–10 shows the query result as an Oracle XDB row set. Example 9–11 prints the result in `WebRowSet` format. In practice, you can access the variable rowset `OracleWebRowSet` instance in Example 9–9 using `oracle.jdbc.rowset.OracleWebRowSet` APIs. For more information on these data types, see the *Oracle Database JDBC Developer's Guide and Reference*.

Example 9–10 Query Results as an Oracle XDB Row Set

```
<ROWSET>
<ROW num="1">
<ENAME>SMITH</ENAME><SAL>800</SAL>
</ROW>
<ROW num="2">
<ENAME>ALLEN</ENAME><SAL>1600</SAL>
</ROW>
<ROW num="3">
<ENAME>WARD</ENAME><SAL>1250</SAL>
</ROW>
</ROWSET>
```

Example 9–11 Query Results as a JDBC Web Row Set

```
<?xml version="1.0" encoding="UTF-8"?>
 <webRowSet xmlns="http://java.sun.com/xml/ns/jdbc"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/jdbc
http://java.sun.com/xml/ns/jdbc/webrowset.xsd">
   <properties>
<command></command>
<concurrency>1007</concurrency>
<datasource></datasource>
<escape-processing>true</escape-processing>
<fetch-direction>1002</fetch-direction>
<fetch-size>10</fetch-size>
<isolation-level>2</isolation-level>
<key-columns>
</key-columns>
<map>
</map>
<max-field-size>0</max-field-size>
<max-rows>0</max-rows>
<query-timeout>0</query-timeout>
<read-only>false</read-only><rowset-type>1005</rowset-type>
<show-deleted>false</show-deleted>
<table-name></table-name>
<url>jdbc:oracle:thin:@stacd15:1521:lsqlj1</url>
<sync-provider>

<sync-provider-name>com.sun.rowset.providers.RIOptimisticProvider</sync-provider-n
ame>
  <sync-provider-vendor>Sun Microsystems Inc.</sync-provider-vendor>
  <sync-provider-version>1.0</sync-provider-version>
```

```
  <sync-provider-grade>2</sync-provider-grade>
  <data-source-lock>1</data-source-lock>
</sync-provider>
   </properties>
   <metadata>
<column-count>2</column-count>
<column-definition>
  <column-index>1</column-index>
  <auto-increment>false</auto-increment>
  <case-sensitive>true</case-sensitive>
  <currency>false</currency>
  <nullable>1</nullable>
  <signed>true</signed>
  <searchable>true</searchable>
  <column-display-size>10</column-display-size>
  <column-label>ENAME</column-label>
  <column-name>ENAME</column-name>
  <schema-name></schema-name>
  <column-precision>0</column-precision>
  <column-scale>0</column-scale>
  <table-name></table-name>
  <catalog-name></catalog-name>
  <column-type>12</column-type>
  <column-type-name>VARCHAR2</column-type-name>
              </column-definition>

<column-definition>
  <column-index>2</column-index>
  <auto-increment>false</auto-increment>
  <case-sensitive>true</case-sensitive>
  <currency>false</currency>
  <nullable>1</nullable>
  <signed>true</signed>
  <searchable>true</searchable>
  <column-display-size>10</column-display-size>
  <column-label>SAL</column-label>
  <column-name>SAL</column-name>
  <schema-name></schema-name>
  <column-precision>0</column-precision>
  <column-scale>0</column-scale>
  <table-name></table-name>
  <catalog-name></catalog-name>
  <column-type>2</column-type>
  <column-type-name>NUMBER</column-type-name>
</column-definition>
   </metadata>
   <data>
<currentRow>
  <columnValue>SMITH</columnValue>
             <columnValue>800</columnValue>
</currentRow>
<currentRow>
  <columnValue>ALLEN</columnValue>
            <columnValue>1600</columnValue>
     </currentRow>
     <currentRow>
       <columnValue>WARD</columnValue>
             <columnValue>1250</columnValue>
     </currentRow>
   </data>
```

```
</webRowSet>
```

Mapping DML Operations to Web Service Operations

A DML statement is an `UPDATE`, `DELETE`, or `INSERT` SQL statement. The `sqlAssemble` command can expose DML statements into operations in a Web Service. DML operations are automatically committed when successful and automatically rolled back when they are not.

Example 9–12 illustrates a WSDL fragment that exposes the DML statement in Example 9–7:

```
updateEmp=update emp SET sal=sal+500 where ename=:{myname
VARCHAR}
```

The DML statement is exposed as two operations. In this example, `updateEmp` executes the statement; `updateEmpiS` executes it in batch mode. The batched operation takes an array for each original DML argument. Each element in the array is used for one execution in the batch. The result of a batched operation reflects the total number of rows updated by the batch.

Example 9–12 WSDL Fragment, Illustrating the Response Type of a DML Operation

```
   <message name="SqlStmts_updateEmp">
     <part name="salary" type="xsd:string"/>
</message>
<message name="SqlStmts_updateSchemaResponse">
    <part name="result" type="xsd:int"/>
</message>
<message name="SqlStmts_updateEmpiS">
    <part name="salary" type="tns:ArrayOfstring"/>
</message>
<message name="SqlStmts_updateEmpiSResponse">
    <part name="result" type="xsd:int"/>
</message>
```

Exposing an Oracle Streams AQ as a Web Service

Oracle Streams Advanced Queuing is an asynchronous messaging system provided by Oracle databases. By exposing an Advanced Queue (AQ) as a Web service, the client can send a message to a receiver inside the database, or eventually, to another client of the same Web service.

The WebServicesAssembler tool can generate a Web service from an AQ existing in a database. An AQ can have a single consumer or multiple consumers. A single consumer is often referred to as a queue. A multiple consumer AQ is often referred to as a topic. Each Oracle Streams AQ belongs to a queue table, which defines the payload type of all its AQs, and whether the AQs support only queues or topics. The generated Java code employs the Oracle Streams AQ JMS APIs.

Example 9–15 on page 9-24 and Example 9–16 on page 9-27 illustrate the Web service operations that the WebServicesAssembler exposes for a queue and a topic, respectively. The assembler creates the operations based on Oracle Streams AQ and AQ JMS APIs. For information regarding Oracle Streams AQ and AQ JMS APIs, refer to the *Oracle Streams Advanced Queuing Java API Reference*.

Prerequisites

Before you begin, provide the following files and information.

- A database connection URL to the database where the AQ resides. As an alternative to JDBC, WebServicesAssembler gives you the flexibility of using a JMS queue instance to access an Oracle AQ. For more information, see "Accessing an Oracle AQ Queue with JMS" on page 9-23.
- The name of the schema where the AQ resides and the user name and password to access it. This is used at compile time.
- The name of the queue or topic that you want to expose as a Web service. You can publish only a single queue or topic to be exposed by a Web service. See "Sample AQ Queue and Topic Declaration" on page 9-23 for a sample queue and topic.
- A name for the Web service application.
- The data source JNDI name. This information is used at runtime.

How to Assemble a Web Service from an Oracle AQ

The following steps describe how to use WebServicesAssembler to assemble a Web service from an Oracle AQ queue.

1. Provide the files and other information described in the Prerequisites section as input to WebServicesAssembler `-aqAssemble` command.

   For example, the following command creates a Web service application with the `queue.ear` file generated in the current directory. The WebServicesAssembler tool generates Java files to access the queue at runtime. "Sample AQ Queue and Topic Declaration" on page 9-23 illustrates the AQ `sample_queue` declaration.

   ```
   java -jar $ORACLE_HOME/webservices/lib/wsa.jar
     -aqAssemble
     -appName queue
     -dataSource jdbc/OracleManagedDS
     -portName assembleQueuePort
     -sql sample_queue
     -dbConnection jdbc:oracle:thin:@stacd15:1521:lsqlj
     -dbUser scott/tiger
   ```

   You can publish the sample topic in the declaration, `sample_topic`, in the same way as `sample_queue` (but in a different WebServicesAssembler invocation). The only difference would be the values for `sql` and `appName` arguments in the `aqAssemble` command.

2. Deploy the service into a running instance of OC4J and bind the application.

   This step assumes that the AQ has been set up as a data source in the OC4J instance.

   The following command lines provide sample deployment and bind commands.

   ```
   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   welcome -deploy -file dist/queue.ear -deploymentName queue

   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   welcome -bindWebApp queue queue-web default-web-site /queue
   ```

   In this example, <*J2EE_HOME*> is the directory where J2EE is installed.

   For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.

3. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web

Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.

4. Generate the client-side code.

   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. For more information on generating and assembling client-side code for the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. For more information on generating and assembling client-side code, see Chapter 13, "Assembling a J2EE Web Service Client".

   For example, the following command uses `genProxy` to generate code for a J2SE client.

```
% java -jar wsa.jar -genProxy
                    -wsdl http://locahost:8888/queue/queue?WSDL
                    -output build/src/client
                    -mappingFileName ./mapping.xml
                    -packageName oracle.demo.db.queue.stub
                    -unwrapParameters true
```

5. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

   The following command lines provide sample compile and run commands.

```
% javac -classpath path
<ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
:<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar QueueClient.java

% java -classpath path
<ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar:
<J2EE_HOME>/lib/jax-qname-namespace.jar:
<J2EE_HOME>/lib/activation.jar:<J2EE_HOME>/lib/mail.jar:
<J2EE_HOME>/lib/http_client.jar:
<ORACLE_HOME>/webservices/lib/commons-logging.jar:
<ORACLE_HOME>/lib/xmlparserv2.jar QueueClient
```

In this example, <*J2EE_HOME*> is the directory where J2EE is installed; <*ORACLE_HOME*> is the directory where OracleAS Web Services is installed.

Ant Tasks for Generating a Web Service

This release provides Ant tasks for Web services development. The following example shows how the WebServicesAssembler `aqAssemble` command can be rewritten as an Ant task.

```
<aqAssemble
   appName="queue"
   dataSource="jdbc/OracleManagedDS"
   sql="sample_queue"
   portName="assembleQueuePort"
   dbConnection="jdbc:oracle:thin:@stacd15:1521:lsqlj"
   dbUser="scott/tiger"
/>
```

Developing Client Code to Access an AQ Queue Exposed as a Web Service

Example 9–13 illustrates a sample client that accesses the published Web service. "Sample Web Service for a Topic Generated by WebServicesAssembler" on page 9-25 illustrates the operations exposed by the queues and topics.

Example 9–13 Client Code to Access an AQ Queue Exposed as a Web Service

```
SampleQueuePortClient queue = new SampleQueuePortClient();
     QueueMessageUser m;
     queue.send(new QueueMessageUser( "star chopper", "sample 1"));
     queue.send(new QueueMessageUser("easy blocks", "sample 2"));
     queue.send(new QueueMessageUser("back to future", "sample 3"));
     m = queue.receive();
     while (m != null) {
         System.out.println("Message received from SampleQueue: " + m.getSubject()
+ ": " + m.getText());
         m = queue.receiveNoWait();
          }
```

This client returns the following responses.

```
Message received from SampleQueue: sample 1: star chopper
Message received from SampleQueue: sample 2: easy blocks
Message received from SampleQueue: sample 3: back to future
```

Accessing an Oracle AQ Queue with JMS

By default, the Web service interface code uses the data source to get a JDBC connection. It then uses the connection to access the queue inside the database.

As an alternative to JDBC, you can use JMS to access the queue. The WebServicesAssembler tool provides these specialized arguments to the `aqAssemble` command that let you access the exposed Oracle AQ with a JMS queue instance.

- aqConnectionLocation—the JDNI location of the Oracle Streams AQ JMS queue connection connecting to the exposed AQ.
- aqConnectionFactoryLocation—the JNDI location of the Oracle Streams AQ JMS queue connection factory for the exposed AQ.

Instead of specifying the `dataSource` argument in the `aqAssemble` command, you can specify either of the parameters above. The Web service will use a JMS queue at runtime instead of a JDBC-based queue.

Sample AQ Queue and Topic Declaration

The PL/SQL script in Example 9–14 defines a queue, `sample_queue`, and a topic, `sample_topic`. The queue payload type is `queue_message`, a SQL object type. The topic payload type is `topic_message`, also a SQL object type.

Example 9–14 Sample Queue and Topic Declaration

```
create type scott.queue_message as object (
   Subject               VARCHAR2(30),
   Text                  VARCHAR2(80));
create type scott.topic_message as object (
   Subject               VARCHAR2(30),
   Text                  VARCHAR2(80));
BEGIN
  dbms_aqadm.create_queue_table (
          Queue_table           => 'scott.queue_queue_table',
          Queue_payload_type    => 'scott.queue_message');
  dbms_aqadm.create_queue(
    queue_name  => 'scott.sample_queue',
    queue_table => 'scott.queue_queue_table' );
  dbms_aqadm.start_queue(queue_name => 'scott.sample_queue');

  dbms_aqadm.create_queue_table (
    Queue_table           => 'scott.topic_queue_table',
    Multiple_consumers => TRUE,
    Queue_payload_type    => 'scott.topic_message');
  dbms_aqadm.create_queue(
    queue_name  => 'scott.sample_topic',
    queue_table => 'scott.topic_queue_table' );
  dbms_aqadm.start_queue(queue_name => 'scott.sample_topic');
END;
/
```

Sample Web Service for a Queue Generated by WebServicesAssembler

For the queue described in "Sample AQ Queue and Topic Declaration", Example 9–15 lists the Web service operations exposed by WebServicesAssembler.

In this example, the `send` operation enqueues a payload to the queue. The payload type is the complex type `tns:QueueMessageUser`, which corresponds to the SQL type `QUEUE_MESSAGE`, as shown by `<send/>` element.

The `receive` operation returns a payload from the queue. The `<receiveResponse/>` element shows that the type of the returned payload is `tns:QueueMessage`. The operation blocks until a message becomes available.

The `receiveNoWait` operation returns a payload from the queue. If no message is available in the queue, the operation returns null without waiting.

The `receive2` operation has two arguments.

- `selector` of type `xsd:string`
- `noWait` of type `xsd:boolean`

The `selector` is a filter condition specified in the AQ convention. It allows the `receive` operation to return only messages that satisfies that condition. For example, the `JMSPriority < 3 AND PRICE < 300` selector exposes only messages with priority 3 or higher, and the attribute `PRICE` is lower than 300. If the parameter `noWait` is `true`, the operation does not block.

Example 9–15 Web Service Operations Exposed for a Queue

```
<operation name="receive">
  <input message="tns:SampleQueue_receive" />
  <output message="tns:SampleQueue_receiveResponse" />
  </operation>
<operation name="receive2">
```

```
  <input message="tns:SampleQueue_receive2" />
  <output message="tns:SampleQueue_receive2Response" />
  </operation>
<operation name="receiveNoWait">
  <input message="tns:SampleQueue_receiveNoWait" />
  <output message="tns:SampleQueue_receiveNoWaitResponse" />
  </operation>
<operation name="send">
  <input message="tns:SampleQueue_send" />
  <output message="tns:SampleQueue_sendResponse" />
  </operation>

<complexType name="receive">
  <sequence />
  </complexType>
<complexType name="receiveResponse">
<sequence>
  <element name="result" type="tns:QueueMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="QueueMessageUser">
<sequence>
  <element name="text" type="string" nillable="true" />
  <element name="subject" type="string" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receive2">
<sequence>
  <element name="String_1" type="string" nillable="true" />
  <element name="boolean_2" type="boolean" />
  </sequence>
  </complexType>
<complexType name="receive2Response">
<sequence>
  <element name="result" type="tns:QueueMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receiveNoWait">
  <sequence />
  </complexType>
<complexType name="receiveNoWaitResponse">
<sequence>
  <element name="result" type="tns:QueueMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="send">
<sequence>
  <element name="QueueMessageUser_1" type="tns:QueueMessageUser" nillable="true"
/>
  </sequence>
  </complexType>
<complexType name="sendResponse">
  <sequence />
  </complexType>
```

Sample Web Service for a Topic Generated by WebServicesAssembler

For the topic described in "Sample AQ Queue and Topic Declaration" on page 9-23, Example 9–16 lists the Web service operations exposed by WebServicesAssembler.

In this example, the `publish` operation enters a payload to the topic. The argument is a payload type, for instance, `tns:TopicMessageUser`, as shown in Example 9–16. The message will be received by all topic subscribers.

The `publish2` operation sends the payload to all the subscribers in the recipients list. This operation takes the following arguments.

- `payload` of type `tns:TopicMessageUser`
- `recipients` of `String` array type

The `publish3` operation broadcasts the payload to the topic. This operation takes the following arguments.

- `payload`, the message to be sent
- `deliveryMode`, of type `xsd:int`—can be either `javax.jms.DeliveryMode.PERSISTENT` or `javax.jms.DeliveryMode.NON_PERSISTENT`. However, only `DeliveryMode.PERSISTENT` is supported in this release. The interface `javax.jms.DeliveryMode` is from the JMS APIs
- `priority`, of type `xsd:int`—specifies the priority of the message. Values can be from 0 to 9, with 0 as lowest priority and 9 as highest.
- `timeToLive`, of type `xsd:long`—indicates the life span of the message in milliseconds. Zero means no limit.

The `receive` operation returns a message sent to the receiver. This operation takes one argument: `receiver`.

The `receiveNoWait` operation returns a message sent to the specified recipient without waiting.

The `receive2` operation returns a filtered message sent to the specified recipient. This operation takes the following arguments.

- `receiver`, of type `xsd:string`—recipient of the filtered message.
- `selector`, of type `xsd:string`—a filter condition specified in the AQ convention.

The `receive3` operation returns filtered payload for the specified recipient. This operation takes the following arguments.

- `receiver`, of type `xsd:string`—recipient of the filtered message.
- `selector`, of type `xsd:string`—a filter condition specified in the AQ convention.
- `timeout`, of type `xsd:long`—specifies the timeout for the operation in milliseconds. Zero means no timeout.

The `subscribe` operation subscribes a user to the topic. The underlying connection supporting the Web service must have appropriate privileges to subscribe a consumer. Otherwise, this operation has no effect.

The `unsubscribe` operation unsubscribes a user from the topic. Again, the underlying connection supporting the Web service must have appropriate privileges to unsubscribe a consumer. Otherwise, this operation has no effect.

For more information on the privileges needed for subscribing and unsubscribing consumers, see the *Oracle Streams Advanced Queuing Java API Reference*.

Example 9–16 Web Service Operations Exposed for a Topic

```
<operation name="publish">
  <input message="tns:SampleTopic_publish" />
  <output message="tns:SampleTopic_publishResponse" />
  </operation>
<operation name="publish2">
  <input message="tns:SampleTopic_publish2" />
  <output message="tns:SampleTopic_publish2Response" />
  </operation>
<operation name="publish3">
  <input message="tns:SampleTopic_publish3" />
  <output message="tns:SampleTopic_publish3Response" />
  </operation>
<operation name="receive">
  <input message="tns:SampleTopic_receive" />
  <output message="tns:SampleTopic_receiveResponse" />
  </operation>
<operation name="receive2">
  <input message="tns:SampleTopic_receive2" />
  <output message="tns:SampleTopic_receive2Response" />
  </operation>
<operation name="receive3">
  <input message="tns:SampleTopic_receive3" />
  <output message="tns:SampleTopic_receive3Response" />
  </operation>
<operation name="receiveNoWait">
  <input message="tns:SampleTopic_receiveNoWait" />
  <output message="tns:SampleTopic_receiveNoWaitResponse" />
  </operation>
<complexType name="publish">
<sequence>
  <element name="TopicMessageUser_1" type="tns:TopicMessageUser" nillable="true"
/>
  </sequence>
  </complexType>
<complexType name="TopicMessageUser">
<sequence>
  <element name="text" type="string" nillable="true" />
  <element name="subject" type="string" nillable="true" />
  </sequence>
  </complexType>
<complexType name="publishResponse">
  <sequence />
  </complexType>
<complexType name="publish2">
<sequence>
  <element name="TopicMessageUser_1" type="tns:TopicMessageUser" nillable="true"
/>
  <element name="arrayOfString_2" type="string" nillable="true" minOccurs="0"
maxOccurs="unbounded" />
  </sequence>
  </complexType>
<complexType name="publish2Response">
  <sequence />
  </complexType>
<complexType name="publish3">
<sequence>
  <element name="TopicMessageUser_1" type="tns:TopicMessageUser" nillable="true"
/>
  <element name="int_2" type="int" />
```

```
  <element name="int_3" type="int" />
  <element name="long_4" type="long" />
  </sequence>
  </complexType>
<complexType name="publish3Response">
  <sequence />
  </complexType>
<complexType name="receive">
<sequence>
  <element name="String_1" type="string" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receiveResponse">
<sequence>
  <element name="result" type="tns:TopicMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receive2">
<sequence>
  <element name="String_1" type="string" nillable="true" />
  <element name="String_2" type="string" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receive2Response">
<sequence>
  <element name="result" type="tns:TopicMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receive3">
<sequence>
  <element name="String_1" type="string" nillable="true" />
  <element name="String_2" type="string" nillable="true" />
  <element name="long_3" type="long" />
  </sequence>
  </complexType>
<complexType name="receive3Response">
<sequence>
  <element name="result" type="tns:TopicMessageUser" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receiveNoWait">
<sequence>
  <element name="String_1" type="string" nillable="true" />
  </sequence>
  </complexType>
<complexType name="receiveNoWaitResponse">
<sequence>
  <element name="result" type="tns:TopicMessageUser" nillable="true" />
  </sequence>
  </complexType>
```

Exposing a Server-Side Java Class as a Web Service

Use the `dbJavaAssemble` command to generate Web services that invoke a Java class inside the Java VM in an Oracle database. You can expose either static or instance methods as Web service operations. An instance method can be invoked through either a default or singleton instance in the session.

The Java class that you want to expose can contain any of the following parameters and return types.

- primitive types (except `char`)
- serializable types
- Java Beans whose attributes are supported types
- JDBC types; that is, `oracle.sql.*` types
- arrays of supported types

Prerequisites

Before you begin, supply the following information.

- The fully-qualified class name of the server-side Java class
- A database connection URL; used at code generation time
- The name and password of the schema which contains the Java class; used at code generation time
- A name for the Web service application
- The data source JNDI name; used at runtime

How to Assemble a Web Service from a Server-Side Java Class

The following steps describe how to use WebServicesAssembler to assemble a Web service from a server-side Java class.

1. Supply the information described in the Prerequisites section as input to WebServicesAssembler `dbJavaAssemble` command.

   For example, in the following `dbAssemble` command, the server-side class, `oracle.sqlj.checker.JdbcVersion`, is part of the SQLJ server-side translator. This command assembles a Web service application for the class, `javacallin.ear`. It also generates a PL/SQL wrapper and a Java stored procedure wrapper. The purpose of the Java stored procedure wrapper is to convert signature types in the server-side Java class into types can be exposed to PL/SQL stored procedures. Since the `sysUser` argument is declared, the WebServicesAssembler automatically loads the generated wrappers into the database.

   ```
   java -jar wsa.jar
     -dbJavaAssemble
     -appName javacallin
     -dbJavaClassName oracle.sqlj.checker.JdbcVersion
     -dbConnection jdbc:oracle:thin:@stacd15:1521:lsqlj
     -dataSource jdbc/OracleManagedDS
     -dbUser scott/tiger
     -sysUser sys/knl_test7
   ```

   At run time, the Web service code uses JDBC to invoke the PL/SQL wrapper, which in turns calls the Java stored procedure wrapper, which eventually calls the server-side class. Example 9–18 on page 9-31 illustrates some Web service operations generated by this command.

2. Deploy the service into a running instance of OC4J and bind the application.

   This step assumes that the data source specified in Step 1 has been installed in this instance of OC4J.

   The following command lines provide sample deployment and bind commands.

   ```
   % java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
   ```

```
welcome  -deploy -file dist/javacallin.ear -deploymentName javacallin

% java -jar <J2EE_HOME>/admin_client.jar deployer:oc4j:localhost:port admin
welcome  -bindWebApp javacallin javacallin-web default-web-site /javacallin
```

In this example, <*J2EE_HOME*> is the directory where J2EE is installed.

For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.

3. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.
4. Generate the client-side code.
   - For the J2SE environment, generate stubs (client proxies) for a J2SE Web service client by running the WebServicesAssembler tool with the `genProxy` command. See Chapter 14, "Assembling a J2SE Web Service Client" for more information on generating and assembling client-side code for the J2SE environment.
   - For the J2EE environment, generate a service endpoint interface and a JAX-RPC mapping file for a J2EE Web service client by running the WebServicesAssembler tool with the `genInterface` command. See Chapter 13, "Assembling a J2EE Web Service Client" for more information on generating and assembling client-side code.

   For example, the following command uses `genProxy` to generate code for a J2SE client.

```
% java -jar wsa.jar -genProxy
                    -wsdl http://locahost:8888/javacallin/javacallin?WSDL
                    -output build/src/client
                    -mappingFileName ./mapping.xml
                    -packageName oracle.demo.db.queue.stub
                    -unwrapParameters true
```

5. Compile and run the client.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar` on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

   The following command lines provide sample compile and run commands.

```
% javac -classpath path
<ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
:<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar JavacallinClient.java

% java -classpath path
<ORACLE_HOME>/webservices/lib/wsclient_extended.jar:
<ORACLE_HOME>/webservices/lib/jaxrpc-api.jar:
<J2EE_HOME>/lib/jax-qname-namespace.jar:
<J2EE_HOME>/lib/activation.jar:<J2EE_HOME>/lib/mail.jar:
<J2EE_HOME>/lib/http_client.jar:
```

```
    <ORACLE_HOME>/webservices/lib/commons-logging.jar:
    <ORACLE_HOME>/lib/xmlparserv2.jar JavacallinClient
```

In this example, <*J2EE_HOME*> is the directory where J2EE is installed; <*ORACLE_HOME*> is the directory where the OC4J is installed.

Ant Tasks for Generating a Web Service

The current release provides Ant tasks for Web services development. The following sample shows how the WebServicesAssembler `dbJavaAssemble` command can be rewritten as an Ant task.

```
<oracle:dbJavaAssemble
   appName="javacallin"
   dbJavaClassName="oracle.sqlj.checker.JdbcVersion"
   dbConnection="jdbc:oracle:thin:@stacd15:1521:lsqlj"
   dataSource="jdbc/OracleManagedDS"
   dbUser="scott/tiger"
   sysUser="sys/knl_test7"
/>
```

Sample Server-Side Java Class

Example 9–17 illustrates two APIs in `oracle.sqlj.checker.JdbcVersion`, a server-side Java class distributed with Oracle9*i* and 10*g* databases. The `dbJavaAssemble` command exposes these APIs as a Web service.

Example 9–17 Sample Server-Side Java Class

```
public class oracle.sqlj.checker.JdbcVersion extends java.lang.Object {
    public static int getDriverMajorVersion();
    public static int getDriverMinorVersion();
    ...
}
```

Sample Web Service Operations Generated from a Server-Side Java Class

The WSDL fragment in Example 9–18 illustrates the Web service operations generated for the `JdbcVersion` APIs `getDriverMajorVersion` and `getDriverMinorVersion` in Example 9–17.

Example 9–18 WSDL Fragment, Illustrating Operations Generated for a Server-Side Java Class

```
<complexType name="getDriverMajorVersion">
  <sequence />
  </complexType>
<complexType name="getDriverMajorVersionResponse">
<sequence>
  <element name="result" type="decimal" nillable="true" />
  </sequence>
  </complexType>
<complexType name="getDriverMinorVersion">
  <sequence />
  </complexType>
<complexType name="getDriverMinorVersionResponse">
<sequence>
  <element name="result" type="decimal" nillable="true" />
  </sequence>
  </complexType>
```

```
<portType name="JdbcVersion">
<operation name="getDriverMajorVersion">
  <input message="tns:JdbcVersion_getDriverMajorVersion" />
  <output message="tns:JdbcVersion_getDriverMajorVersionResponse" />
  </operation>
<operation name="getDriverMinorVersion">
  <input message="tns:JdbcVersion_getDriverMinorVersion" />
  <output message="tns:JdbcVersion_getDriverMinorVersionResponse" />
  </operation>
  </portType>
```

Note: A server-side Java class can also be invoked through JDBC (rather than through Web services). If this is the case, refer to the *Oracle Database JPublisher User's Guide* to find out how to generate a proxy class for invoking database server-side Java.

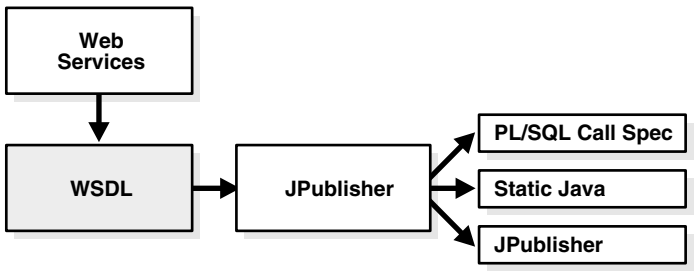
Developing a Web Service Client in the Database

Oracle JPublisher supports PL/SQL and Java Web service call-outs by creating the appropriate stub code. This enables you to use PL/SQL or Java to invoke a Web service client from inside the database. For a Web service call-out, you supply a WSDL file or location to Oracle JPublisher. Oracle JPublisher generates a PL/SQL wrapper and the necessary database server-side Java classes that implement the PL/SQL wrapper. The generated PL/SQL wrapper contains a PL/SQL procedure or function for each Web service operation.

As an alternative, Oracle JPublisher has the ability to generate Java client proxies only. These Java client proxies can be used for Web service call-outs by Java code in the database.

Figure 9–3 illustrates the stub code that Oracle JPublisher can generate.

Figure 9–3 Creating Web Service Call Out Stubs



Note: If you must dynamically construct invocations of external Web services based on a WSDL which is available only at runtime, use the JAX-RPC Dynamic Invocation Interface API for Java or the PL/SQL `UTL_DBWS` package.

The client proxy which Oracle JPublisher generates is based on the simplified client code generated for Java proxies in OracleAS Web Services 10.1.3. Therefore, the Java and PL/SQL client which Oracle JPublisher generates is fully supported by OracleAS Web Services 10.1.3. In addition, Oracle JPublisher can also generate OracleAS Web Services 9.0.4-style Web service clients.

Web service call-out requires these utilities and tools.

- Database Release 9.2 or later
- Database Web Service call-out Utilities

  Load the JAR and SQL files into the database as instructed. These utilities are available from the Oracle Database Web Services Web site.

  http://www.oracle.com/technology/tech/webservices/database.html
- Oracle JPublisher 10*g*

  If you do not have Oracle JPublisher installed, you can obtain it from the JDBC, SQLJ, and Oracle JPublisher download Web site.

  http://www.oracle.com/technology/tech/java/java_db/index.html

These are the required Oracle JPublisher options for Web service call-outs.

- `proxywsdl`—the URL of the WSDL file for the Web service to be invoked
- `user`—the database schema (and password) for which the PL/SQL wrapper is generated

These are the optional Oracle JPublisher parameters.

- `httpproxy`—the HTTP proxy host and port for accessing the WSDL file
- `sysuser`—the database user (and password) with SYSDBA privileges
- `proxyopts`—a list of options specific to `proxywsdl`
- `dir`—the directory storing all the generated files

The `sysUser` argument allows Oracle JPublisher to load the generated file into the database. If this argument is not declared, you must manually load the generated file into the database to invoke the Web service from PL/SQL.

See the *Oracle Database JPublisher User's Guide* for examples and options related to Web service call-out, such as `proxywsdl`, `proxyopts`, and `httpproxy`.

Tool Support for Web Services that Expose Database Resources

With Oracle JDeveloper, you can create a Web service based on program units in a PL/SQL package that is stored in an Oracle database. You can use the wizards in JDeveloper to perform the following tasks.

- Create the PL/SQL Package in the Database
- Create the PL/SQL Web service
- Deploy the PL/SQL Web service
- Create a stub to use the Web service

For more information on using JDeveloper to create PL/SQL package units and expose them as a Web service, see the JDeveloper on-line help.

Limitations

See "Developing Web Services From Database Resources" on page C-5.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building J2SE clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- building J2EE clients, see Chapter 13, "Assembling a J2EE Web Service Client".
- JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services"
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

10

Assembling Web Services with Annotations

This chapter describes how to use annotations to quickly develop Web services from Java classes. You can use the annotations feature only when you are performing bottom up development of a Web service from Java classes.

The standard Java mechanisms for the design, development, and deployment of Web services require you to leverage a substantial amount of information. For example, to deploy a service based on a Java class you must provide the class itself, an associated service endpoint interface, and potentially, additional metadata files. For more information on generating a Web service with Java classes, see Chapter 6, "Assembling a Web Service with Java Classes".

Oracle Application Server Web Services provides support for J2SE 5.0 JDK Web Services Annotations. J2SE 5.0 Web Services annotations is part of an ongoing standard and is supported by other platforms. The following lists describe the advantages and disadvantages of using the J2SE 5.0 Web Services annotations.

J2SE 5.0 Web Services Annotations Advantages

- Based on a community standard.
- Supported by the J2SE 5.0 JDK. The metadata is stored directly in the class file, making them portable.
- Language-level IDE support. IDEs that support the J2SE 5.0 JDK will recognize J2SE 5.0 Web Service annotations and be able to provide things like auto-completion and syntax checking.

J2SE 5.0 Web Services Annotations Disadvantages

- Requires you to use the J2SE 5.0 JDK.
- See the limitations described in the following section.

Developing Web Services with J2SE 5.0 Annotations

OracleAS Web Services provides support for J2SE 5.0 Web Service annotations (also known as the Web Services Metadata for the Java Platform (JSR-181) specification). The specification defines an annotated Java syntax for programming Web services. The specification is available from the following Web site.

`http://www.jcp.org/en/jsr/detail?id=181`

Using the annotated Java syntax requires the J2SE 5.0 JDK. The J2SE 5.0 JDK also provides documentation on the language-level support for annotations, such as how to define them, their syntax, and how to create new annotations. The J2SE 5.0 JDK is available from the following Web site.

http://java.sun.com/j2se/1.5.0/download.jsp

Java Metadata Annotations is a feature in J2SE 5.0 JDK that enables you to add special tags to your Java classes. These tags are then compiled into the class byte code and made accessible to third party annotation processors. The Web Services Metadata for the Java Platform specification further extends this feature with metadata tags for Web services. OracleAS Web Services supports this specification and allows developers to customize the Web services generation process through the use of annotations.

Since metadata annotations are a J2SE 5.0 feature, you must have the JVM from the J2SE 5.0 JDK to use Web service annotations in OracleAS Web Services. The WebServicesAssembler tool can generate Web services from Java classes that have J2SE 5.0 annotations. When the tool is used in a J2SE 5.0 JDK JVM, the `assemble` and `genWsdl` commands will process annotations in a given Java class.

The EJB 3.0 specification has extended the Web Services Metadata for the Java Platform specification by adding metadata tags for EJBs. The specification supports the Web Services Metadata for the Java Platform tags, allowing EJBs to be exposed as Web services. EJB 3.0 annotations are processed when an EAR file containing EJBs is deployed to a running Oracle Application Server. Any interfaces with J2SE 5.0 annotations that are implemented by session beans will be processed. Note that you cannot use the WebServicesAssembler tool to process EJB 3.0 annotations.

How to Use J2SE 5.0 Annotations to Assemble a Web Service from Java Classes

To assemble a Web service from a Java class with J2SE 5.0 annotations, follow these steps.

1. Add Web service metadata annotations to the implementation class.

   Example 10–1 illustrates a sample annotated Java file.

   a. At a minimum, the `@WebService` metadata tag must be present in the class.

   b. Add the `endpointInterface` property to the `@WebService` metadata tag in the implementation class if you want to reference a service endpoint interface. Note that if the service endpoint interface also has an `@WebService` tag, the annotations will be processed at that starting point instead.

   c. Add the `@WebMethod` annotation to each method you want to expose in the Web service. Note that if your annotations are in the service endpoint interface, then all of the methods will be exposed, regardless of whether they have the `@WebMethod` annotation.

2. Compile the annotated classes.

   The classes must be compiled with a JDK 5.0-compliant compiler.

3. Generate the Web service artifacts (such as the WSDL, the deployment descriptors, and so on) by using the WebServicesAssembler `assemble` command

   a. You must specify the implementation class as the value of the `assemble` command's `className` argument. This is true even if all of your annotations are in the service endpoint interface. The implementation class must have an `@WebService` annotation.

   b. If you only want to generate a WSDL from an annotated Java class, use the `genWsdl` command and supply the implementation class as the value of the `className` argument.

How to Use J2SE 5.0 Annotations to Assemble a Web Service from a Version 3.0 EJB

Web services can be assembled from EJB 3.0-compliant beans at deployment time. To generate a Web service endpoint from an EJB 3.0 bean, follow these steps.

1. Add an `@Stateless` metadata tag to the bean.

   Only stateless EJB session beans are supported.

   The `name` property of the `@Stateless` annotation provides the name of the Web service endpoint. If this property is not specified, then the default endpoint name will be the unqualified class name of the EJB bean class.

2. Add the `@WebService` tag to the interface that the bean implements.

   a. Enter the tag in the interface. Do not enter it in the actual bean class.

   b. At a minimum, the interface must contain the `@WebService` tag.

   c. Add the `@WebMethod` annotation to each method you want to expose in the Web service.

   d. The interface must be implemented by the EJB bean class.

3. (Optional) Add the `@Deployment` tag to the interface with values for the `uriPath` and `portName` attributes.

   By default, the port name and default URI for an EJB 3.0 bean is the EJB name. This name is found in the `@Stateless` annotation of the bean. If the name of the bean is not specified in the `@Stateless` annotation, the short class name of the bean will be used instead. You can override this by providing values for the `uriPath` and `portName` attributes of the `@Deployment` tag.

4. Compile the EJB classes and package them into an EAR file. Deploy the EAR file to a running instance of OC4J.

Supported J2SE 5.0 Annotation Tags

OracleAS Web Services provides support for the entire set of annotation tags described in the Web Services Metadata for the Java Platform specification. The tags appear in the following list.

- `javax.jws.WebMethod`
- `javax.jws.Oneway`
- `javax.jws.WebParam`
- `javax.jws.WebResult`
- `javax.jws.HandlerChain`
- `javax.jws.soap.SOAPBinding`
- `javax.jws.soap.SOAPMessageHandlers`

Oracle Additions to J2SE Annotations

This section describes the Oracle-proprietary annotations that can be read and processed by the Java Metadata Annotations feature in the J2SE 5.0 JDK.

Deployment Annotation

The `@Deployment` annotation can be used to supply the deployment attributes to an endpoint implementation or to a service endpoint interface. It is an optional annotation that has only optional properties.

The `oracle.webservices.annotations.Deployment` class defines the `@Deployment` annotation.

Table 10–1 describes the attributes supported by the `@Deployment` annotation. All the attributes of this tag are optional.

Table 10–1 Deployment Annotation Attributes

Attribute	Description
contextPath	This value specifies the default context for the Web service. If you want to package multiple Web services in a WAR file and each endpoint class has an `@Deployment` annotation, then the value of the `contextPath` attribute must be the same for all of the services. This is because `contextPath` is global to a Web service deployment. If the Web services have differing `contextPath` values, then their behavior will be unpredictable. If only one `contextPath` property is set, then that will be the root context for all Web services in the same EAR or WAR file. You can override the value of this attribute by providing a valid value for the `<context-root>` element in the `oracle-webservices.xml` deployment descriptor that is deployed with the EAR file. Setting `<context-root>` in the deployment descriptor overrides all `contextPath` properties in all Web services that have the `Deployment` annotation.
portName	This value specifies the `portName` element in the generated WSDL. Each Web service can have a different `portName` value. You can override the value of the `portName` attribute by entering a value for the `<port-component [name] >` attribute in the `oracle-webservices.xml` deployment descriptor deployed with the EAR file.
restSupport	This Boolean value identifies whether the service is a REST Web service. If `true`, the port will supports REST-style `GET` and `POST` requests and responses. Default is `false`.
uriPath	This value is appended to the value of the `contextPath` attribute. Each Web service can have a different `uriPath` value. You can override the value of this attribute by providing a URI in the `<endpoint-address-uri>` element for the corresponding `<port-component [name] >`. These elements must appear in the same service element in the `oracle-webservices.xml` deployment descriptor deployed with the EAR file. Note: if there is a conflict in between the values of `<url-pattern>` in the `web.xml` deployment descriptor and the value of `uriPath`, then the value of `<url-pattern>` will take precedence.

The following example illustrates an interface that uses the `@Deployment` annotation. In this example, the Web service will be accessed by the URL `http://$HOST:$PORT/ejb30/ejb30-simple` after it is deployed.

```
...
@WebService(name="CustomSession",
            targetNamespace="http://ejb.oracle.com/targetNamespace",
            serviceName="CustomSessionBeanService")
```

```
@Deployment(contextPath="ejb30",
            uriPath="ejb30-simple",
            portName="Custom")
public interface CustomSessionIntf extends Remote{
...
```

Overriding Annotations

This section describes how you can override annotation values in a Java file by using deployment descriptors or WebServicesAssembler.

- Overriding Annotation Values with WebServicesAssembler
- Overriding Deployment Annotation Values with Deployment Descriptors

Overriding Annotation Values with WebServicesAssembler

Command line arguments passed to the WebServicesAssembler `assemble` and `genWsdl` commands will override any annotations in the Java class file that perform the same function. For example, if you pass the `portName` argument to the `assemble` or `genWsdl` command, then its value will override the value of the `@Deployment.portName` annotation.

Overriding Deployment Annotation Values with Deployment Descriptors

If you want to override any of the properties specified by the Oracle-proprietary `@Deployment` annotation, you can package a deployment descriptor that provides an override in the EAR file in `META-INF/oracle-webservices.xml` (or `WEB-INF/oracle-webservices.xml` for Web modules).

When you use an `oracle-webservices.xml` deployment descriptor to override `@Deployment` annotation properties, each `<webservice-description>` element in the descriptor must match a Web service being deployed based on the `serviceName` of the Web service. The `serviceName` is specified by `@WebService.serviceName` annotation.

Note that if you are assembling multiple Web services that use the `@Deployment` annotation and you specify a deployment descriptor that overrides the properties for only one of the services, then the other services will not be affected. In the deployment descriptor, you should specify only those properties you want to override.

For example, the values in the following XML fragment from an `oracle-webservices.xml` deployment descriptor override the `@Deployment` annotation properties. Since this fragment provides values for the `<port-component name>` attribute and the `<endpoint-address-uri>` element, the annotation's `portName` and `uriPath` attributes will be overridden. The `<context-root>` element was not specified in this example, so the annotation's `contextPath` property will not be overridden.

```
<webservice-description name="CustomSessionBeanService">
    <port-component name="CustomSession">
          <endpoint-address-uri>/custom-session</endpoint-address-uri>
    </port-component>
</webservice>
```

Of course, instead of annotating the class you could just provide an `oracle-webservices.xml` deployment descriptor to specify the deployment properties.

Sample Java File with J2SE 5.0 Annotations

To generate Web services from Java classes, you can enter J2SE 5.0 annotations in either of these files.

- the endpoint class only
- the endpoint class and the service endpoint interface

If you choose to enter the annotations in both the endpoint class and the service endpoint interface, then you need to enter only minimal annotations in the endpoint class.

Example 10–1 illustrates an example of an implementation class with Web service metadata annotations. Note how the `@WebService`, `@WebMethod`, and `@WebParam` annotations are used in the example.

- The `@WebService` annotation specifies the `serviceName` and `targetNamespace`. These properties are used to populate the `wsdl:service name` and `wsdl:targetNamespace` elements in the generated WSDL file.

  Optionally, you can specify the `endpointInterface` property with the fully-qualified class name of an service endpoint interface. In this case, provide the following annotations.

  - Enter only the `@WebService` annotations in the endpoint class, and enter the correct value for `endpointInterface`. In the case where `endpointInterface` is used, all Web service-related annotations are ignored, except for the `@WebService` annotation on the endpoint class.
  - Enter the `@WebMethod` and `@WebParam` annotations in the service endpoint interface.
- The `@WebMethod` annotations identify the methods that should be present in the Web service. These annotated methods will be assembled into `wsdl:operation` elements in the generated WSDL. If a value for the `operationName` property is specified in the `@WebMethod` annotation, then it will be used as the operation name for the `wsdl:operation`. If a value is not provided, then the name of the method is used by default.
- The `@WebParam` annotations identify message parts or parameters to `wsdl:operations`. An optional `Mode` can be specified for each parameter. The `INOUT` or `OUT` modes can be specified only for parameters that implement the `javax.xml.rpc.holders.Holder` interface. By default, a parameter that implements the `Holder` interface becomes an `INOUT` parameter, unless `Mode.OUT` is explicitly specified by an annotation. All other parameters must be `IN` parameters.

Example 10–1 Sample Java File with J2SE 5.0 Web Service Metadata Annotations

```
package oracle.webservices.examples.annotations;

import java.rmi.RemoteException;
import javax.jws.*;
import javax.jws.WebParam.Mode;

@WebService (
    serviceName = "annotatedBank",
    targetNamespace = "http://service.annotatedBank"
)
public class BankServiceImpl {
    @WebMethod (operationName="create-account")
```

```
    public String createAccount( @WebParam(name="accountName") String acctName,
                                 float initBalance )
        throws RemoteException, AccountException {
        return m_bank.addNewAccount(acctName,initBalance);
    }

    @WebMethod
    public void deposit( @WebParam(name="accountID", mode=Mode.IN) String acctID,
                         float amount )
        throws RemoteException, AccountException {
        Account theAccount = m_bank.getAccount(acctID);
        if ( theAccount == null ) {
            throw new AccountException("No account found for " + acctID);
        }
        theAccount.deposit(amount);
    }
    //class truncated…
}
```

Limitations

See "Assembling Web Services with Annotations" on page C-6.

Additional Information

For more information on:

- using the Home Page to test Web service deployment, see Chapter 12, "Testing Web Service Deployment".
- building J2SE clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- building J2EE clients, see Chapter 13, "Assembling a J2EE Web Service Client".
- JAX-RPC handlers, see Chapter 15, "Understanding JAX-RPC Handlers".
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

11

Assembling REST Web Services

REST (Representational State Transfer) Web services architecture conforms to the Web architecture defined by the World Wide Web Consortium (W3C), and leverages its architectural principles. It uses the semantics of HTTP whenever possible. REST Web services use XML documents, not SOAP envelopes, for sending messages. Unlike SOAP Web Services, REST is a "style" and has no standards or tools support from vendors.

When you use Oracle Application Server Web Services to expose an endpoint by using REST support, that endpoint is also exposed as a SOAP port. OracleAS Web Services limits the support of HTTP commands to GET and POST. REST Web services deploy like any other OracleAS Web Services.

> **Note:** OracleAS Web Services can assemble REST Web services only where the use, or encoding mechanism, is literal (`use=literal`). It does not support REST Web services where the message format is encoded.

Web service management features, such as security and reliability, are not available with REST Web services. This is because SOAP headers, which are typically used to carry this information, cannot be used with REST Web service invocations.

Assembling REST Web Services

You can use WebServicesAssembler to add REST Web service capabilities to any Web application that can use HTTP as a protocol. This includes Web service applications built on Java classes, EJBs, and database resources. WebServicesAssembler provides a Boolean `restSupport` argument that will allow any of the following commands to assemble a REST Web service.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble

How to Assemble a REST Web Service Top Down

The following steps illustrate assembling a REST Web service from a WSDL. This example provides only an outline of the steps required for top down Web service assembly. For a detailed description of each of the steps, see Chapter 5, "Assembling a Web Service from a WSDL"

1. Provide a WSDL from which the Web service will be generated as input to the WebServicesAssembler `genInterface` command. Example 11–1 illustrates the WSDL used in this example.

   ```
   java -jar wsa.jar -genInterface
                     -output build/src/service
                     -wsdl wsdl/MovieFacility.wsdl
                     -unwrapParameters false
   ```

2. Compile the generated interface and type classes.
3. Implement the Java service endpoint for the Web service you want to provide.
4. Compile the Java service endpoint.
5. Generate the service by running the WebServicesAssembler tool with the `topDownAssemble` command. Set the `restSupport` argument to `true`. For example:

   ```
   java -jar wsa.jar -topDownAssemble
               -wsdl ./wsdl/MovieFacility.wsdl
               -unwrapParameters false
               -className oracle.webservices.examples.rest.RpcLitMovieImpl
               -input build/classes/service
               -output build
               -ear dist/rpclit_topdown.ear
               -restSupport true
   ```

6. Deploy the service.

   Deploy the EAR file in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.

7. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. The Home Page enables you to generate and invoke any REST POST or GET requests. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.

> **Note:** REST Web services do not use J2EE or J2SE clients. However, since every REST endpoint is also a SOAP endpoint, you can assemble a J2SE or J2EE clients for those endpoints. For examples of how to create GET or POST REST messages, use the Web Services Home Page.

Accessing REST Web Service Operations

Example 11–1 illustrates a fragment of the WSDL used to assemble the RPC-Literal service in "How to Assemble a REST Web Service Top Down".

Example 11–1 WSDL Fragment for an RPC-Literal Web Service

```
<definitions xmlns="http://schemas.xmlsoap.org/wsdl/"
xmlns:tns0="http://www.oracle.com/rest/doc/types"
```

```
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
xmlns:tns="http://www.oracle.com/rest" name="rest-service"
targetNamespace="http://www.oracle.com/rest"
xmlns:http="http://schemas.xmlsoap.org/wsdl/http/">
    <types>
        <schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:soap11-enc="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:tns="http://www.oracle.com/rest/doc/types" elementFormDefault="qualified"
targetNamespace="http://www.oracle.com/rest/doc/types">
            <complexType name="Movie">
                <sequence>
                    <element name="Title" type="xsd:string"/>
                    <element name="Director" type="xsd:string"/>
                    <element name="Year" type="xsd:int" />
                </sequence>
            </complexType>
            <complexType name="ArrayOfMovie">
                <sequence>
                    <element name="Movie" type="tns:Movie"
                                    maxOccurs="unbounded" />
                </sequence>
            </complexType>
        </schema>
    </types>
    <message name="FindMoviesRequest">
        <part name="TitleWords" type="xsd:string" />
        <part name="Year" type="xsd:int" />
    </message>
    <message name="FindMoviesResponse">
        <part name="Movies" type="tns0:ArrayOfMovie" />
    </message>
    <message name="AddMovieRequest">
        <part name="Movie" type="tns0:Movie" />
    </message>
    <message name="AddMovieResponse">
        <part name="Added" type="xsd:boolean" />
    </message>
    <portType name="MovieDB">
         <operation name="findMovies">
             <input message="tns:FindMoviesRequest" />
             <output message="tns:FindMoviesResponse" />
         </operation>
         <operation name="addMovie">
             <input message="tns:AddMovieRequest" />
             <output message="tns:AddMovieResponse" />
         </operation>
     </portType>

    <binding name="HttpSoap11Binding" type="tns:MovieDB">
        <soap:binding style="rpc"
transport="http://schemas.xmlsoap.org/soap/http"/>
        <operation name="findMovies">
            <soap:operation soapAction="http://www.oracle.com/rest/findMovies"/>
            <input>
                <soap:body use="literal" parts="TitleWords Year"
namespace="http://www.oracle.com/rest"/>
```

```
            </input>
            <output>
                <soap:body use="literal" parts="Movies"
namespace="http://www.oracle.com/rest"/>
            </output>
        </operation>
        <operation name="addMovie">
            <soap:operation soapAction="http://www.oracle.com/rest/addMovie"/>
            <input>
                <soap:body use="literal" parts="Movie"
namespace="http://www.oracle.com/rest"/>
            </input>
            <output>
                <soap:body use="literal" parts="Added"
namespace="http://www.oracle.com/rest"/>
            </output>
        </operation>
    </binding>
    <service name="rest-service">
        <port name="HttpSoap11" binding="tns:HttpSoap11Binding">
            <soap:address
location="http://localhost:8888/webservice/webservice/"/>
        </port>
    </service>
</definitions>
```

Using the preceding WSDL, the procedure described in "How to Assemble a REST Web Service Top Down" produces the following generated interface:

```
interface MovieDb {
    public Movie[] findMovies (String titleWords, int year);
    public boolean addMovie (Movie movie);
}
```

The first method in the generated interface has only simple parameters. This method can be invoked with an HTTP GET. For example:

```
http://{yourhost}/{context-path}/{service-url}/findMovie?TitleWords=Star+Wars&Year
=1977
```

This query string returns the following XML response:

```
<ns0:findMoviesResponse xmlns:ns0="http://www.oracle.com/rest">
   <Movies>
      <ns1:Movie xmlns:ns1="http://www.oracle.com/rest/doc/types">
         <ns1:Title>tim</ns1:Title>
         <ns1:Director>tim</ns1:Director>
         <ns1:Year>1978</ns1:Year>
      </ns1:Movie>
   </Movies>

</ns0:findMoviesResponse>
```

The `addMovie` method in the generated interface takes a complex parameter; it can only be invoked with an HTTP POST. For example, you can POST the following XML message to the URL of your Web service, `http://{yourhost}/{context-path}/{service-url}`.

```
<ns0:addMovieResponse xmlns:ns0="http://www.oracle.com/rest">
   <Added>true</Added>
</ns0:addMovieResponse>
```

How to Assemble a REST Web Service Bottom Up

The following steps illustrate assembling a REST Web service from Java classes. This example provides only an outline of the steps required for bottom up Web service assembly. For a detailed description of each of the steps, Chapter 6, "Assembling a Web Service with Java Classes".

1. Provide the compiled Java class that you want to expose as a Web service and its compiled interface. Example 11–2 illustrates the `StringTools` interface that is used in this example.
2. Generate the service artifacts by running the WebServicesAssembler tool with the `assemble` command. Set the `restSupport` argument to `true`.

```
java -jar wsa.jar -assemble
           -appName tools
           -serviceName StringTools
           -interfaceName oracle.webservices.examples.rest.StringTools
           -className oracle.webservices.examples.StringToolsImpl
           -input ./build/classes/service
           -output build
           -use literal
           -ear dist/tools.ear
           -uri StringToolsService
           -restSupport true
```

3. Deploy the service and bind the application.

   Deploy EAR files in the standard manner into a running instance of OC4J. For more information on deploying EAR files, see the *Oracle Containers for J2EE Deployment Guide*.
4. (Optional) Check that deployment succeeded. OracleAS Web Services provides a Web Service Home Page for each deployed Web service. The Home Page enables you to generate and invoke any REST POST or GET requests. See "Using the Web Services Home Page" on page 12-1 for information on accessing and using the Web Service Home Page.

> **Note:** REST Web services do not use J2EE or J2SE clients. However, since every REST endpoint is also a SOAP endpoint, you can assemble J2SE or J2EE clients for those endpoints. For examples of how to create GET or POST REST messages, use the Web Services Home Page.

Accessing REST Web Service Operations

Example 11–2 illustrates the `StringTools` interface that is used to assemble the REST Web service in Step 2 above.

Example 11–2 Interface Used to Assemble REST Web Services

```
interface StringTools {
package oracle.webservices.examples.rest;
import java.rmi.Remote;
import java.rmi.RemoteException;

public interface StringTools extends Remote{
    public String appendStrings (String a, String b) throws RemoteException;
    public String toUpperCase (String c) throws RemoteException;
    public String concatArrayOfStrings (String s[]) throws RemoteException;
```

The first two methods in the interface, `appendStrings` and `toUpperCase`, use atomic parameters. As REST Web service operations, these operations can be accessed with HTTP GET. The following example illustrates a call to the `appendStrings` operation, if `document` style is specified at assembly time:

```
http://{yourserver}/{context-path}/{service-URL}/appendStrings?String_
1=Hello+&String_2=World
```

This query string would return the following XML response:

```
<appendStringsResponseElement xmlns="{yournamespace}">
     <result>Hello World</result>
</appendStringsResponseElement>
```

The third method in the interface, `concatArrayOfStrings` takes a non-atomic parameter. As a REST Web service operation, it cannot be called using HTTP GET. It can only be called with HTTP POST. For example:

```
<ns1:concatArrayOfStringsElement
xmlns:ns1="http://oracle.webservices.examples.rest/">
            <ns1:arrayOfString_1>a,</ns1:arrayOfString_1>
            <ns1:arrayOfString_1>b.</ns1:arrayOfString_1>
</ns1:concatArrayOfStringsElement>
<concatArrayOfStringsRequest xmlns="{yournamespace}">
```

This request string would return the following XML code:

```
<ns0:concatArrayOfStringsResponseElement
xmlns:ns0="http://oracle.webservices.examples.rest/">
   <ns0:result>a,b.</ns0:result>
</ns0:concatArrayOfStringsResponseElement>
```

REST Additions to Deployment Descriptors

If REST support is enabled for a Web service, then an optional Boolean `<rest-support>` subelement is added to the `<port-component>` element of the `oracle-webservices.xml` deployment descriptor. If `<rest-support>` is set to `true`, then the port to which the subelement is applied will support REST-style `GET` and `POST` requests and responses. The default value is `false`. For more information on this subelement, see "<port-component> Element" on page 18-15.

Using J2SE 5.0 Annotations to Assemble REST Web Services

An optional Boolean `restSupport` attribute can be applied to the `@Deployment` tag in J2SE 5.0 annotations. Its value indicates whether the service is a REST Web service. If `true`, the port to which the annotation is applied will support REST-style `GET` and `POST` requests and responses. For more information on this attribute and the `Deploy` tag, see "Oracle Additions to J2SE Annotations" on page 10-3.

Testing REST Web Services

You can use the Web Services Home Page to test whether REST Web services deployed successfully. See "Using the Web Services Home Page for REST Services" on page 12-7 for more information.

Building Requests and Responses

The following sections describe how REST Web service requests are formed on the client side and how they are processed on the server side.

HTTP GET Requests

Suppose a SOAP endpoint is deployed at the following URL:

```
http://example.com/my-app/my-service
```

If this endpoint is REST enabled, then HTTP GET requests will be accepted at the following URL:

```
http://example.com/my-app/my-service/{operationName}?{param1}={value1}&{param2}={value2}
```

In this example, {*operationName*} is one of the operation names in the WSDL for the service. For RPC-literal operations, {*param1*}, {*param2*}, and so on, are the part names defined in the operation's input `wsdl:message`. Note that these must be `simpleTypes` (`xsd:int`, and so on).

> **Note:** Some browsers limit the size of the HTTP GET URL. Try to keep the size of the URL small by using a limited number of parameters and short parameter values.

For document-literal operations, messages have only a single parameter. To simulate multiple parameters, the WSDL specifies a single parameter that is defined in the schema as a `sequence`. Each member of the sequence is considered a parameter. In this case, {*param1*}, {*param2*}, and so on, will be the members of the sequence type, instead of `message` parts. As with RPC, these must be `simpleTypes`.

Example 11–3 illustrates the request message defined for an operation named `addNumbers`.

Example 11–3 GET Request on an Operation

```
<wsdl:message name="AddNumbersRequest">
      <wsdl:part name="a" type="xsd:int" />
      <wsdl:part name="b" type="xsd:int" />
</wsdl:Message>
```

This request can be invoked by using a GET with the following URL:

```
http://{yourhost}/{context-path}/{service-url}/addNumbers?a=23&b=24
```

Example 11–4 illustrates the SOAP envelope that the OracleAS Web Services platform will create on the server side from the GET request. This message will be processed like any other incoming SOAP request.

Example 11–4 SOAP Envelope Created from a GET Request

```
<soap:Envelope>
    <soap:Body>
        <ns:addNumbers>
            <ns:a>23</ns:a>
            <ns:b>24</ns:b>
        </ns:addNumbers>
    <soap:Body>
```

```
<soap:Envelope>
```

Example 11–5 illustrates the request message sent for the `addNumbers` service when it is defined as a document-literal operation.

Example 11–5 Sample GET Request on an Document-Literal Wrapped Operation

```
<wsdl:message name="AddNumbersRequest">
     <wsdl:part name="params" type="tns:AddNumbersRequstObject" />
</wsdl:Message>
```

Example 11–6 illustrates the definition of the `AddNumbersRequestObject` as it would be defined in the schema.

Example 11–6 XML Definition of a Document-Literal Wrapped Operation

```
<xsd:complexType name="AddNumbersRequestObject">
    <xsd:complexContent>
        <xsd:sequence>
            <xsd:element name="a" type="xsd:int"/>
            <xsd:element name="b" type="xsd:int"/>
        </xsd:sequence>
    </xsd:complexContent>
</xsd:complexType>
```

This operation can be invoked by a GET request with the following URL. Note that this is the same URL that is used for the RPC-literal request in Example 11–3.

`http://{`*yourhost*`}/{`*context-path*`}/{`*service-url*`}/addNumbers?a=23&b+24`

HTTP POST Requests

REST Web services support HTTP POST requests that are simple XML messages—not SOAP envelopes. REST requests do not support messages with attachments. Since the service also supports SOAP requests, the implementation must determine if a given request is meant to be SOAP or REST.

When a SOAP service receives a POST request, it looks for a `SOAPAction` header. If it exists, the implementation will assume that it is a SOAP request. If it does not, it will find the `QName` of the root element of the request. If it is the SOAP Envelope `QName`, it will process the message as a SOAP request. Otherwise it will process it as a REST request.

REST requests will be processed by wrapping the request document in a SOAP envelope. The HTTP headers will be passed through as received, except for the Content-Type header in a SOAP 1.2 request. This Content-Type header will be changed to the proper content type for SOAP 1.2, `application/soap+xml`.

For example, the following REST request illustrated in Example 11–7 will be wrapped in the SOAP envelope illustrated in Example 11–8.

Example 11–7 REST Request

```
<ns:addNumbers>
    <ns:a>23</ns:a>
    <ns:b>24</ns:b>
</ns:addNumbers>
```

The request illustrated in Example 11–8 will be processed as a normal SOAP request.

Example 11–8 SOAP Envelope Wrapping the REST Request

```
<soap:Envelope>
       <soap:Body>
               <ns:addNumbers>
                       <ns:a>23</ns:a>
                       <ns:b>24</ns:b>
               </ns:addNumbers>
          </soap:Body>
</soap:Envelope>
```

REST Responses

For any request (either GET or POST) that was processed as a REST request, the response must also be in REST style. The OracleAS Web Services platform will transform the SOAP response on the server into a REST response before sending it to the client. The REST response will be an XML document whose root Element is the first child Element of the SOAP Body. For example, assume that the SOAP envelope illustrated in Example 11–9 exists on the server.

Example 11–9 SOAP Response

```
<soap:Envelope>
    <soap:Body>
        <ns0:result xmlns:nso="…">
            <ns:title>How to Win at Poker</ns:title>
            <ns:author>John Doe</ns:author>
        </ns0:result>
    </soap:Body>
</soap:Envelope>
```

Example 11–10 illustrates the response sent back to the client. Note that the Content-Type will always be `text/xml`. Any SOAP Headers or attachments will not be sent back to the client.

Example 11–10 REST Response

```
<ns0:result xmlns:ns0="…">
       <ns:title>How to Win at Poker</ns:title>
       <ns:author>John Doe</ns:author>
</ns0:result>
```

Tool Support for REST Web Services

The **Create Java Web Service** wizard in JDeveloper provides an option for enabling REST functionality for a Web service. For more information on using JDeveloper to enable REST functionality in a Web Service, see the JDeveloper on-line help.

Limitations

See "Assembling REST Web Services" on page C-6.

Additional Information

For more information on:

- assembling a Web service from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".

- assembling a Web service from Java classes, see Chapter 6, "Assembling a Web Service with Java Classes".
- assembling a Web service from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling a Web service from database resources, see Chapter 9, "Developing Database Web Services".
- testing REST Web services, see Chapter 12, "Testing Web Service Deployment".

12

Testing Web Service Deployment

This chapter provides information on how to test if your Web Service deployed successfully. You can do this by either accessing the Web service by using the Web Service Home Page or by accessing the WSDL by using the Web service URL.

- Using the Web Services Home Page
- Obtaining a Web Service WSDL Directly

> **Note:** The Web Services Page in the Application Server Control tool lists all of the available Web Services, and links to their Home Pages. For more information, see the topic "Web Services Page" in the Application Server Control on-line help.

Using the Web Services Home Page

Oracle Application Server Web Services provides a Web Service Home Page for each deployed Web service. The Home Page can be used for either JAX-RPC Web services or REST services.

- How to Access the Web Services Home Page
- How to Use the Web Services Home Page
- Using the Web Services Home Page for REST Services

How to Access the Web Services Home Page

To access a Home Page, enter the address of a service endpoint in a Web browser. The address has the format:

`http://host:port/context-root/service`

Table 12–1 describes the components of the address.

Table 12–1 URL Components for Accessing the Home Page

URL Component	Description
context-root	The value specified in the `<context-root>` element for the web module associated with the Web service. See the `META-INF/application.xml` in the Web service's EAR file to determine this value.
host	The host name of the Web service's server running OracleAS Web Services.

Table 12–1 (Cont.) URL Components for Accessing the Home Page

URL Component	Description
port	The port name of the Web service's server running OracleAS Web Services.
service	The value specified in the `<url-pattern>` element for the servlet associated with the Web service. This is the service name. See the `WEB-INF/web.xml` file in the Web service's WAR file to determine this value.

How to Use the Web Services Home Page

The following steps describe how to access and use the functionality in the Web Services Home Page.

1. Enter the address of the service endpoint in a Web browser.

   The Web Service Home Page for the service appears in the browser. Figure 12–1 illustrates a sample Home Page. For more information on how to perform this step, see "How to Access the Web Services Home Page". For more information on the Home Page see "Understanding the Web Service Home Page".

2. Click the link belonging to the operation you want to test.

   The operation's Editor Page opens. Figure 12–2 illustrates the Editor Page.

3. Enter the parameter values, if any, for the operation.

   If the parameter or element is optional or nillable, then a checkbox will appear next to the parameter or element name. If the checkbox is clear, then the parameter or element will not be included in the Test Page. See "Understanding the Web Service Editor Page" on page 12-3 for more information on how to use this page.

4. Click the **Preview SOAP** button.

   The Invocation Page opens The Invocation Page contains two text boxes. The top text box displays the SOAP message created by the entries made in the Editor Page. The lower text box contains an empty text area that will contain the SOAP response from the server. See "Understanding the Web Service Invocation Page" on page 12-5 for more information on how to use this page.

5. Click the **Invoke** button to send the test message to the endpoint.

   The response to the test message will appear in the lower text box in the Invocation Page. See "Understanding the Web Service Invocation Page" on page 12-5 for more information on how to use this page.

The following sections describe the components of the Web Services Home Page:

- Understanding the Web Service Home Page
- Understanding the Web Service Editor Page
- Understanding the Web Service Invocation Page

Understanding the Web Service Home Page

The Home Page displays the list of operations available for the Web service, and links to the Web service's WSDL and the service's JavaScript stub.

Each operation name on the Home Page links to the Editor Page where you can input the parameter values that you want to test. "Understanding the Web Service Editor Page" provides more information on this page.

The **Service Description** link opens the WSDL for the Web service. You can save the file locally.

Figure 12–1 shows the Web Service Home Page for `HelloService`, at the endpoint:

```
http://localhost:8888/hello/HelloService
```

This example also displays a link for this Web service's one operation: `hello`.

Figure 12–1 Web Service Home Page

Understanding the Web Service Editor Page

The Editor Page opens when you click an operation name in the Web Service Home Page. Use the Editor Page to test a Web service operation for different parameter values. You can also use this page to test security and reliability settings if these management features have been enabled for the service. The following sections describe how you can use the Editor Page to test these operation parameters and management features with different values.

- Editing Operation Parameters and Elements
- Editing Security and Reliability Settings

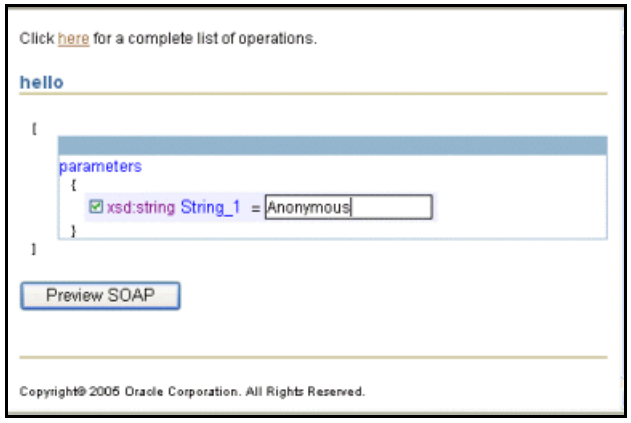
Editing Operation Parameters and Elements The Editor Page displays a table containing the operation's parameters or elements, their data types, and an editable text box where you can enter parameter values. If the parameter or element is optional or nillable, then a checkbox will appear next to the parameter or element name.

- Mark the checkbox if you want the parameter or element to participate in the test.
- Clear the checkbox if you do not want to input values to the optional parameter or element.
- Click the **Preview SOAP** button to view the SOAP request for the operation with the parameter or element values.

Click the **Preview SOAP** button to open the Invocation Page and display the SOAP request that will be sent to the service. For more information on this page, see "Understanding the Web Service Invocation Page".

Figure 12–2 illustrates a sample Editor Page. In this figure, the `hello` operation is being tested, with the `string_1` parameter set to `Anonymous`.

Figure 12–2 Editor Page for Testing a Web Service Operation



Editing Security and Reliability Settings if Web service security and/or reliability have been enabled for the service, then the Editor Page also enables you to test the service for different settings for these management features.

If WS-Reliability has been enabled for the service, the Editor Page displays a table containing the **WS-Reliability Header** label and the reliability features you can test. Figure 12–3 illustrates an Editor Page that displays the entries for WS-Reliability features.

A checkbox next to the **WS-Reliability Header** label indicates whether the reliability features will participate in the test.

- Mark the checkbox if you want the test to include reliability features. The reliability SOAP header will be inserted into the SOAP envelope.
- Clear the checkbox if you do not want the test to include reliability features. The reliability SOAP header will not be inserted into the SOAP envelope.

If you want the test to include reliability, then you can choose different settings for these features:

- duplicate elimination—turning this feature "on" will insert the `DuplicateElimination` reliability header into the message. This tells the reliable endpoint to eliminate duplicates of the message that will be sent.
- guaranteed delivery—turning this feature "on" will insert the `GuaranteedDelivery` reliability header into the message. This tells the reliable endpoint that it must acknowledge receiving the message.
- reply to URL—the URL to which acknowledgments and faults will be sent for messages that want asynchronous acknowledgements. The URL is typically the host name of the client, with the port that the listener is on.
- reply pattern—indicates how the client can interact with the endpoint. The values can be `Callback` (asynchronous acknowledgment/fault), `Response` (synchronous acknowledgement/fault), or `Polling` (the acknowledgment or fault must be polled for).

See "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on these reliability features.

If WS-Security has been enabled for the service, the Editor Page displays a table containing the **WS-Security Header** label and the security features you can test. Figure 12–3 illustrates an Editor page that displays the entries for WS-Security features.

A checkbox next to the **WS-Security Header** label indicates whether the security features will participate in the test.

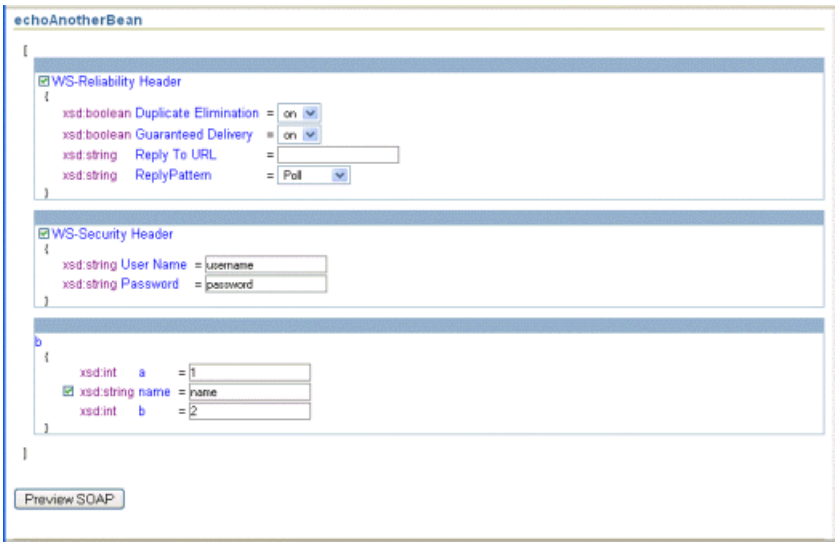
- Mark the checkbox if you want the test to include security features. The security SOAP header will be inserted into the SOAP envelope.
- Clear the checkbox if you do not want the test to include security features. The security SOAP header will not be inserted into the SOAP envelope.

For WS-Security, you can enter values for these parameters:

- user name
- password

For more information on the security features that are available for OracleAS Web Services, see the *Oracle Application Server Web Services Security Guide*.

Figure 12–3 Editor Page for Testing Web Service Management Features



Understanding the Web Service Invocation Page

The Invocation Page opens when you click the **Preview SOAP** button in the Editor Page. The Invocation Page contains two text boxes. The upper text box displays the SOAP message created by the values you provide in the Editor page. The lower text box contains an empty text area that will contain the SOAP response from the server. The page also contains a link to return you to the list of the service's operations.

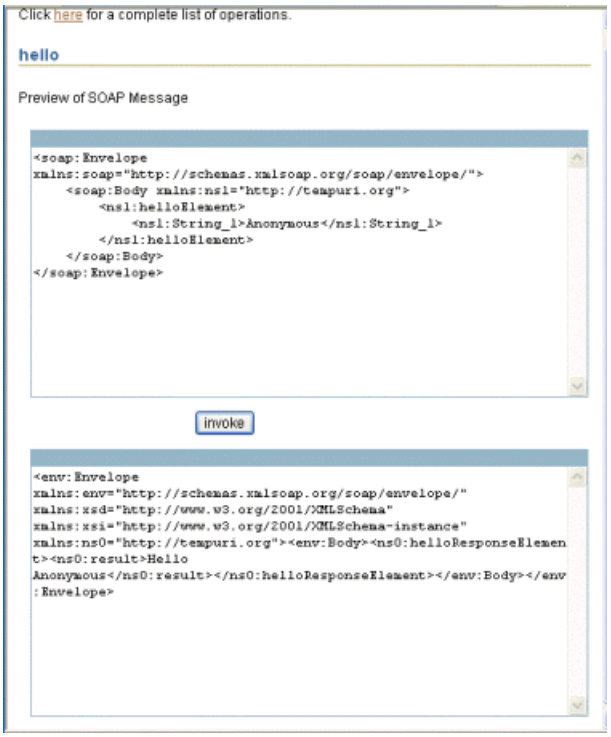
Click the **Invoke** button to send the request to the service. The lower text box will display the SOAP response from the service.

Figure 12–4 illustrates a sample Invocation Page that will send the `Anonymous` value for the `hello` operation to the service.

Figure 12–4 Invocation Page Displaying a SOAP Request

Figure 12–5 illustrates the Invocation Page after clicking **Invoke**. The lower text box contains the response from the service.

Figure 12–5 Invocation Page Displaying a SOAP Request and Response



Using the Web Services Home Page for REST Services

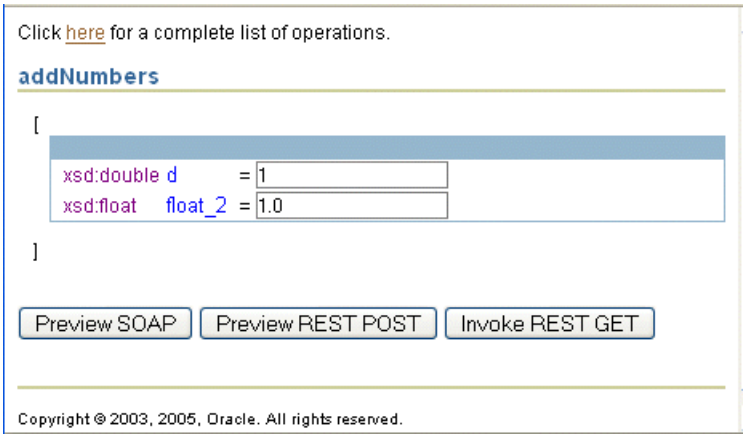
You can use the Web Services Home Page to test REST Services. REST Services are described in Chapter 11, "Assembling REST Web Services".

The Home Page and Invocation Page for REST Services provide the same functionality as for JAX-RPC Web Services. However, if you select an operation on the Home Page that is REST-enabled, then the Editor Page provides two additional buttons that allow you to preview the XML REST POST request and to invoke the GET URL.

- **Preview REST POST**—enables you to generate and invoke a REST POST request.
- **Invoke REST GET**—redirects the page to the GET URL.

Figure 12–6 illustrates an Editor Page for a REST-enabled operation.

Figure 12–6 Editor Page for Testing a REST Web Service Operation

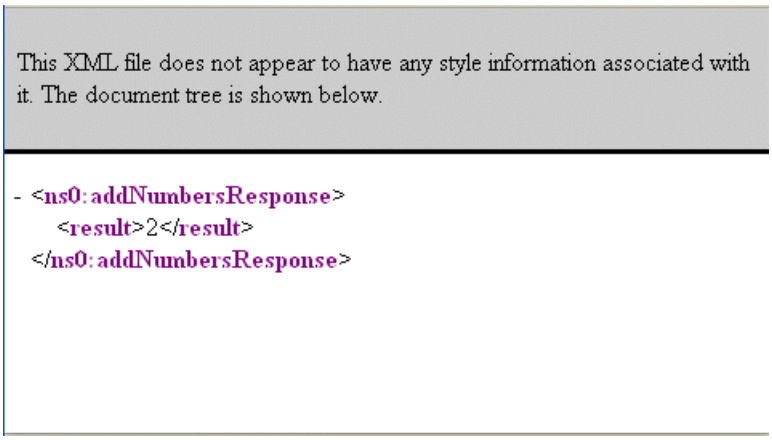


Click **Preview REST POST** on the Editor Page to open the Invocation Page for REST Services. The upper text box displays the XML message created by the values you provide in the Editor Page. The lower text box contains an empty text area that will contain the XML response from the service.

Click the **Invoke** button to send the XML request to the service. The lower text box will display the XML response from the service.

Click **Invoke REST GET** on the Editor Page to display the XML REST GET invocation. The correct URL will be displayed in the browser. Figure 12–7 illustrates an XML REST GET invocation.

Figure 12–7 REST GET Invocation



Obtaining a Web Service WSDL Directly

If you do not use the Web Service Home Page to get the WSDL file for a Web service, you can obtain this file directly.

To obtain the WSDL, use the Web service URL and append a query string. The format for the URL to obtain the WSDL service description is:

`http://host:port/context-root/service?WSDL`

`WSDL` can be either uppercase or lowercase. Table 12–1 on page 12-1 contains a description of the URL components.

This URL returns a WSDL description in the form *service*`.wsdl`. The *service*`.wsdl` description contains the WSDL for the Web service named *service*, located at the specified URL. Using the WSDL, you can build a client application to access the Web service.

Limitations

See "Testing Web Service Deployment" on page C-7.

Additional Information

For more information on Web services that can use the Web Services Home Page, see the following chapters:

- Chapter 5, "Assembling a Web Service from a WSDL"
- Chapter 6, "Assembling a Web Service with Java Classes"
- Chapter 7, "Assembling a Web Service with EJBs"
- Chapter 9, "Developing Database Web Services"
- Chapter 11, "Assembling REST Web Services"
- "Using Web Service Providers" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

For more information on Web service security and reliability, see these resources:

- for adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- for adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

13

Assembling a J2EE Web Service Client

This chapter describes how to develop a Web service client from within a J2EE container. Any component of a J2EE 1.4-compliant container, such as a version 2.4 servlet, 2.1 EJB, or 2.0 JSP application can act as a J2EE Web service client.

This chapter contains the following sections:

For information on assembling a Web service client that runs in the J2SE environment, see Chapter 14, "Assembling a J2SE Web Service Client".

Understanding J2EE Web Service Clients

The J2EE platform provides an environment that allows client applications to access Web services. In a J2EE environment, the deployment descriptors define the client-side Web service access information. This access information can be changed at deployment time. In addition, the J2EE platform handles the underlying work of creating and initializing access to Web services.

J2EE Web service clients inherit the advantages of the J2EE platform, such as declarative security, transactions, and instance management. In addition to these platform characteristics, the OracleAS Web Services management framework makes it possible to configure SOAP logging and auditing, WS-Reliability, and WS-Security.

Unlike the J2SE Web service client, the J2EE client resides in and is managed by the OC4J container. It requires no proxy code generation or packaging. You get a portable client application with Web service access that is easy to embed in JSPs, servlets, and EJBs. EJB variants such as Container Managed Persistence (CMP), Bean Managed Persistence (BMP), and Message-Driven Beans (MDB) can call out to Web service endpoints.

Prerequisites

Before you begin, supply the following files and information.

- The WSDL file or location from which the service endpoint interface and JAX-RPC mapping file will be generated.
- The location where the generated service endpoint interface and JAX-RPC mapping file will be stored.

How to Assemble a J2EE Web Service Client

Use the WebServicesAssembler tool to assemble a service endpoint interface and the J2EE Web service client. Then, edit the deployment descriptor to add Web service access information. The following steps describe these tasks in more detail.

1. Provide the WSDL and the information described in the Prerequisites section as input to the WebServicesAssembler `genInterface` command. For example:

   ```
   java -jar wsa.jar
        -genInterface
        -wsdl HelloService.wsdl
        -output build -packageName oracle.demo.hello
   ```

   This command line uses `HelloService.wsdl` to generate `HelloInterface` in the `oracle.demo.hello` package.

2. Edit the deployment descriptor of the J2EE component to add a `<service-ref>` element. This element captures all of the Web service access information.

   See "Adding J2EE Web Service Client Information to Deployment Descriptors" on page 13-4 for a sample of the `<service-ref>` element and its sub-elements.

   If the client also provides message processing in the form of JAX-RPC handlers, then these also must be added to the deployment descriptor. See "Adding JAX-RPC Handlers to Deployment Descriptors" on page 13-11 for more information on adding handler information to the deployment descriptor.

3. Assemble the client deployment module into an EAR file:

   a. Compile all the client files.

   b. Copy deployment descriptor files to their appropriate locations. For example, for an EJB, copy the WSDL to `META-INF/wsdl/`, the JAX-RPC mapping file and the deployment files such as `ejb-jar.xml` and `orion-ejb-jar.xml` to `META-INF`, and so on. For a description of where files should reside for servlet, EJB, or JSP Web service clients, see "Packaging Structure for Web Service Applications" on page 18-2.

   c. Package the client deployment module.

   > **Note:** The current tool set cannot package J2EE Web service clients. You must package the client manually. "Packaging a J2EE Client" on page 13-16 provides more information on how to package a J2EE Web service client.

4. Deploy the client deployment module.

   The following steps will deploy an EJB, JSP, or other J2EE client. If you are deploying an application client, skip these steps and continue with "Deploying and Running an Application Client Module".

   a. Start OC4J. The following is a sample command to start OC4J.

      ```
      java -jar oc4j.jar
      ```

   b. Deploy the client module into OC4J. The following is a sample deployment command.

      ```
      java -jar admin_client.jar deployer:oc4j:<oc4jHost>:<oc4jPort> <adminID>
      <adminPassword>
               -deploy
      ```

```
        -file .\client\myClient.ear
        -deploymentName myClient
        -bindWebApp default-web-site
```

The *oc4jHost* and *oc4jPort* variables are the host name and port number of the OC4J server. The *adminID* and *adminPassword* are the OC4J server user name and password. The following are sub-switches of the `-deploy` switch.

- `file`—path and filename of the EAR file to deploy.
- `deploymentName`—user-defined application deployment name, used to identify the application within OC4J.
- `bindWebApp`—specifies the Web site to which the web application should be bound. This is the Web site that will be used to access the application.

5. Run the EJB or JSP client.

   If you are running an application client, see "Deploying and Running an Application Client Module".

Deploying and Running an Application Client Module

The following steps describe how to deploy and run an application client module. Unlike EJB, JSP, or other J2EE clients, you must specify the directory where the generated `deployment-cache.jar` will be stored. You must also specify the location of the `deployment-cache.jar` in the run command.

1. Start OC4J. The following is a sample command to start OC4J.

   ```
   java -jar oc4j.jar
   ```

2. Deploy the application client module into OC4J. The following is a sample deployment command.

   ```
   java -jar admin_client.jar deployer:oc4j:<oc4jHost>:<oc4jPort> <adminID>
   <adminPassword>
            -deploy
            -file .\client\myAppClient.ear
            -deploymentName myAppClient
            -deploymentDirectory C:\home\myDir
   ```

   This command creates a `deployment-cache.jar` file and stores it in `C:\home\myDir`.

   The *oc4jHost*, *oc4jPort*, *adminID*, and *adminPassword* variables and the `file` and `deploymentName` sub-switches of `-deploy` are described in Step 4b of the previous section.

   The `deploymentDirectory` sub-switch indicates the location where OC4J deploys `deployment-cache.jar`. In this example, OC4J deploys it into `C:\home\myDir`. If you do not specify this sub-switch, OC4J deploys the application into the *OC4J_HOME*`/application-deployments/` directory. If you supply the empty string (" "), OC4J will always read the deployment configurations from the EAR file each time the application is deployed.

3. Run the client deployment module. For an application client, the location of the `deployment-cache.jar` must be present in the classpath. The following is a sample run command:

   ```
   java -classpath .:C:\home\myDir\deployment-cache.jar:'oc4jclient.jar'
     :appclient.jar oracle.myappclient.classname
   ```

In this sample, it is assumed that `appclient.jar` contains the class `oracle.myappclient.`*classname*.

Ant Task for Generating an Interface

The current release provides Ant tasks for Web service development. The following sample code shows how the `genInterface` command in the preceding example can be rewritten as an Ant task.

```
<oracle:genInterface wsdl="${etc.web1.dir}/HelloService.wsdl"
        output="build"
        packageName="oracle.demo.hello"
/>
```

Adding J2EE Web Service Client Information to Deployment Descriptors

You must edit the J2EE component's deployment descriptor to add information that allows the component to access the Web service endpoint.

- For an EJB 2.1 Web service client, edit the `META-INF/ejb-jar.xml` deployment descriptor.
- For a JSP 2.0 or servlet Web service client, edit the `WEB-INF/web.xml` deployment descriptor.
- For an application client, edit the `META-INF/application-client.xml` deployment descriptor.

Edit the deployment descriptor to add a `<service-ref>` element. By adding this element, you can employ an EJB, JSP, or servlet as a Web service client that can invoke a remote Web service. The `<service-ref>` element and its subelements capture all the Web service access information, such as the location of the WSDL and mapping file, the service interface, the service ports, their related service endpoint interfaces, and so on. For a complete listing of all the information that can be included in the `<service-ref>` element, see the `service-ref` (J2EE client) schema.

`http://java.sun.com/xml/ns/j2ee/j2ee_web_services_client_1_1.xsd`

Example 13–1 illustrates a sample `<service-ref>` element that has been added to a `web.xml` deployment descriptor for the `MyHelloService` Web service. The `<service-ref>` subelements in this example are described in Table 13–1. Note that this sample `<service-ref>` uses only a subset of all of the Web service access information available in the schema.

Example 13–1 Contents of a Sample service-ref Element

```
<service-ref>
    <service-ref-name>service/MyHelloServiceRef</service-ref-name>
    <service-interface>javax.xml.rpc.Service</service-interface>
    <wsdl-file>WEB-INF/wsdl/HelloService.wsdl</wsdl-file>
    <jaxrpc-mapping-file>WEB-INF/HelloService-java-wsdl-mapping.xml
    </jaxrpc-mapping-file>
    <service-qname xmlns:service-qname_ns__="http://hello.demo.oracle/">
    service-qname_ns__:HelloService</service-qname>
    <port-component-ref>
         <service-endpoint-interface>oracle.demo.hello.HelloInterface
         </service-endpoint-interface>
         <port-component-link></port-component-link>
    </port-component-ref>
</service-ref>
```

Table 13–1 describes the `<service-ref>` sub-elements used in this sample.

Table 13–1 Sub-elements of the <service-ref> Element

service-ref Subelement	Description
<service-ref-name>	Specifies the JNDI path and service name assigned by the client.
<service-interface>	Specifies the fully-qualified class name of the JAX-RPC Service interface the client depends on. In most cases the value will be `javax.xml.rpc.Service`. A JAX-RPC generated Service Interface class may also be specified.
<wsdl-file>	Specifies the fully-qualified path to the WSDL file.
<jaxrpc-mapping-file>	Specifies the fully-qualified path to the JAX-RPC mapping file.
<service-qname>	Specifies the service `QName` for the service: ▪ `xmlns:ns`—maps to the `targetNamespace` value in the WSDL. ▪ `ns`—maps to the `service name` attribute in the WSDL.
<port-component-ref>	Declares a client dependency on the container for resolving a service endpoint interface to a WSDL port. It optionally associates the service endpoint interface with a particular port-component. The container uses this only for a `Service.getPort(Class)` method call.
<service-endpoint-interface>	Specifies the fully-qualified Java class that represents the service endpoint interface of a WSDL port.
<port-component-link> (optional)	If the Web service is implemented in the same module as the client, you can add this element to access the service. For more information on this element, see "Accessing a Web Service".

Accessing a Web Service

To enable the Oracle Application Server to access a Web service that resides in the same module as the client, add the `<port-component-link>` element to the `<service-ref>` clause of the client deployment descriptor and add the `PortComponentLinkResolver` property to the `system-application.xml` configuration. The following steps summarize these tasks.

1. Add the `<port-component-link>` element to the `<service-ref>` clause in the J2EE client deployment descriptor.

   "Adding a Port Component Link to a J2EE Client Deployment Descriptor" provides more information on this step.

2. Shut down the Oracle Application Server.

3. Add the `PortComponentLinkResolver` property to the `system-application.xml` server configuration file. This file resides in the directory *`ORACLE_HOME`*`/j2ee/home/config`.

   Add the following lines to this file.

   ```
   <ejb-module id="PortComponentLinkResolver"
   path="../../../webservices/lib/wsserver.jar"/>
   ```

4. Re-start the Oracle Application Server.

Adding a Port Component Link to a J2EE Client Deployment Descriptor If the Web service resides in the same container as the client, then you can access the service by adding the `<port-component-link>` element to the `<service-ref>` clause of the J2EE client deployment descriptor (`web.xml`, `ejb-jar.xml`, or `application-client.xml`).

The `<port-component-link>` element links a `<port-component-ref>` to a specific port component in the server-side deployment descriptor. The `<port-component-name>` element resides in the server-side deployment descriptor, `webservices.xml`.

The following examples illustrate this relationship. The `webservices.xml` fragment in Example 13–2 illustrates the deployment configuration for the Web service that exposes the EJB `InterModuleEjb`. In this fragment, the port component is named `InterPC`. Example 13–3 illustrates a fragment of a client-side deployment descriptor where this name is referenced from the `<port-component-link>` element in the `<service-ref>` clause. The presence of this element allows the J2EE client to look up the Web service.

These examples assume that the Web service is running in the same container as the J2EE Web service client.

Example 13–2 webservices.xml Fragment, Identifying a Port Component Name

```
<webservices>
  <webservice-description>
    <webservice-description-name>InterModuleEjb</webservice-description-name>
    <wsdl-file>META-INF/wsdl/InterModuleService.wsdl</wsdl-file>
    <jaxrpc-mapping-file>META-INF/InterModuleService.xml</jaxrpc-mapping-file>
    <port-component>
      <port-component-name>InterPC</port-component-name>
      <wsdl-port
        xmlns:wsdl1="http://PortCompLink.org/ejb/inter">wsdl1:InterModuleSeiPort
      </wsdl-port>
      <service-endpoint-interface>oracle.demo.InterModuleSei
      </service-endpoint-interface>
      <service-impl-bean>
        <ejb-link>InterModuleEjb</ejb-link>
      </service-impl-bean>
    </port-component>
</webservices>
```

Example 13–3 illustrates a fragment of a client-side deployment descriptor where the value of the `<port-component-name>` element in the server-side deployment descriptor is referenced from the `<port-component-link>` element in the `<service-ref>` clause. The presence of this element allows the client to look up the Web service.

Note that the value of the port component name in the `<port-component-link>` is prefixed by `PortCompLinkEjb-ejb.jar#`. This value qualifies the name of the EJB with the JAR file where it resides.

Example 13–3 <port-component-link> Element in the Client-Side Deployment Descriptor

```
  <service-ref>
    <service-ref-name>service/portcomplink/inter</service-ref-name>
    <service-interface>javax.xml.rpc.Service</service-interface>
    <wsdl-file>META-INF/wsdl/InterModuleService.wsdl</wsdl-file>
```

```
    <jaxrpc-mapping-file>META-INF/InterModuleService.xml</jaxrpc-mapping-file>
    <port-component-ref>
       <service-endpoint-interface>oracle.demo.InterModuleSei
       </service-endpoint-interface>
       <port-component-link>PortCompLinkEjb-ejb.jar#InterPC</port-component-link>
    </port-component-ref>
  </service-ref>
```

Adding OC4J-Specific Platform Information

The `<service-ref-mapping>` element can appear as a subelement of the `<orion-web-app>` element in the `orion-web.xml`, `orion-ejb-jar.xml`, or `orion-application-client.xml` proprietary deployment descriptor files. It defines OC4J-specific runtime and deployment-time generated settings for a Web service reference. It also specifies security, logging, and auditing quality of service (QOS) features for the corresponding Web service.

The `<service-ref-mapping>` element is used in conjunction with the `<service-ref>` element that appears in the standard deployment descriptors. The `<service-ref>` element contains the information that lets you employ an EJB, JSP, or servlet as a Web service client that can invoke a remote Web service.

Note that whenever a `<service-ref>` element can appear in a `web.xml`, `ejb-jar.xml`, or `application-client.xml` file, a corresponding `<service-ref-mapping>` element can appear in an `orion-web.xml`, `orion-ejb-jar.xml`, or `orion-application-client.xml` file.

The `<service-ref-mapping>` element's supported features are described in the `service-ref-mapping-10_0.xsd` that is imported into the `orion-web`, `orion-ejb-jar`, and `orion-application-client` XSDs. Currently, there is no tool support, such as JDeveloper wizards, for providing values to `service-ref-mapping-10_0.xsd`. You must refer to the schema and edit the XML file by hand.

In its simplest case, the `<service-ref-mapping>` element contains only deployment information. Do not add run-time or quality of service elements if you do not want your client to be managed. A managed client is more expensive in terms of performance.

Example 13–4 contains a sample `<service-ref-mapping>` segment. So that you can see this element's hierarchy, all the subelements are displayed. The tables following the XML sample describe the sub-elements.

Example 13–4 Sample <service-ref-mapping> Segment

```
<service-ref-mapping name="service/MyJAXRPCTime">
  <service-impl-class>oracle.demo.MyTime_Impl</service-impl-class>
  <wsdl-file final-location="file:/myhome/mytime/client-wsdl/MyJAXRPCTime.wsdl">
  <wsdl-location wsdl-override-last-modified=19NOV>
  <service-qname namespaceURI="urn:oracle-ws" localpart="MyService" />
  <stub-property>
   <name>...</name>
   <value>...</value>
  </stub-property>
  <call-property>
     <name>javax.xml.rpc.service.endpoint.address</name>
     <value>http://myhost:8888/time-ejb/timeport</value>
  </call-property>
  <port-info>
    <wsdl-port>
```

```
    <service-endpoint-interface>time.TimeService</service-endpoint-interface>
    <stub-property>
      <name>another.endpoint.address</name>
      <value>http://anotherhost:8888/time-ejb/timeport</value>
    </stub-property>
    <call-property>
      <name>...</name>
      <value>...</value>
    </call-property>
    <runtime>...</runtime>
    <operations>
      <operation name="echo">
         <runtime>
           <auditing request="true" response="false" fault="false"/>
           <reliability><reject-non-reliable-messages
value="false"/></reliability>
           ...
         </runtime>
     </operation>
   </operations>
  </port-info>
</service-ref-mapping>
```

Table 13–2 describes the subelements of `<service-ref-mapping>`.

Table 13–2 Subelements of the <service-ref-mapping> Element

Element Name	Description
<service-impl-class>	Defines a deployment-time generated name of a `Service` implementation.
<wsdl-file>	Defines a deployment-time generated name for the WSDL file. This element has this attribute: ■ `final-location`—points to the copy of the WSDL document associated with the `service-ref` in the standard deployment descriptor.
<wsdl-location>	(Optional) Contains a valid URL pointing to a WSDL document. If a URL is specified, then the WSDL document at this URL will be used during deployment instead of the WSDL document associated with the `service-ref` in the standard deployment descriptor. Sample values for `<wsdl-location>` include: `http://hostname:port/myservice/myport?WSDL` and `file:/home/user1/myfinalwsdl.wsdl`. This element has this attribute: ■ `wsdl-override-last-modified`—this optional string value is generated at deployment time and lists the time when the WSDL file was last modified.
<service-qname>	Derived at deployment-time, this element contains the `QName` of the Web service.
<stub-property>	Defines the stub property values applicable to all ports. This is a convenient way to specify a property without specifying the port name. The `name` and `value` subelements of `<stub-property>` are described in Table 13–6 on page 13-10. Note that the `<port-info>` element also contains a `<stub-property>` element. If stub property values are specified for a particular port inside the `<port-info>` tag, then they will override the values set here.

Table 13–2 (Cont.) Subelements of the <service-ref-mapping> Element

Element Name	Description
<call-property>	Defines the call property values applicable to all ports. This is a convenient way to specify a property without specifying the port name. The `name` and `value` subelements of `<call-property>` are described in Table 13–6 on page 13-10. Note that the `<port-info>` element also contains a `<call-property>` element. If call property values are specified for a particular port inside the `<port-info>` tag, then they will override the values set here.
<port-info>	Defines a port within a service-reference. See Table 13–3 on page 13-9 for a description of the subelements of `<port-info>`.

Table 13–3 describes the sub-elements for the `<port-info>` element. This element provides all of the information for a port within a service reference. You can specify either `<service-endpoint-interface>` or `<wsdl-port>` to indicate the port that the container will use for container-managed port selection. If you specify both, then the container will use the `<wsdl-port>` value. If you do not specify `<wsdl-port>` or `<service-endpoint-interface>`, then the `<port-info>` property values will apply to all available ports.

The `<port-info>` element also contains subelements that let you specify quality of service features that are available for the port and its operations.

Table 13–3 Subelements of the <port-info> Element

Element Name	Description
<wsdl-port>	Specifies the name of a port in the WSDL that the container will use for container-managed port selection. In container-managed port selection, the container manages calls to the instance directly, and the client requests a generic port that might be used to access multiple different instances.
<service-endpoint-interface>	Specifies the fully-qualified path to the service endpoint interface of a WSDL port. The container uses this port for container-managed port selection.
<stub-property>	Defines the stub property values applicable to the port defined by the `<port-info>` element. The `name` and `value` subelements of `<stub-property>` are described in Table 13–6 on page 13-10. Note that the `<service-ref-mapping>` element also contains a `<stub-property>` subelement (described in Table 13–2 on page 13-8). If stub property values are specified for a particular port inside the `<port-info>` tag, then they override the `<stub-property>` element values set under `<service-ref-mapping>`.
<call-property>	Defines the call property values applicable to the port defined by the `<port-info>` element. The `name` and `value` sub-elements of `<call-property>` are described in Table 13–6 on page 13-10. Note that the `<service-ref-mapping>` element also contains a `<call-property>` subelement (described in Table 13–2 on page 13-8). If call property values are specified for a particular port inside the `<port-info>` tag, then they override the `<call-property>` element values set under `<service-ref-mapping>`.

Table 13–3 (Cont.) Subelements of the <port-info> Element

Element Name	Description
<runtime>	Contains client-side quality of service runtime information (security and/or reliability) applicable to all the operations provided by the referenced Web service. Each child element contains configuration for a specific feature.
<operations>	Contains a sequence of elements, one for each operation. The `<operation>` subelement indicates an individual operation. Each of these subelements contain client-side quality of service configuration for a single operation provided by the referenced Web service. For a description of the `<operations>` subelement, see Table 13–4 on page 13-10.

Table 13–4 describes the `<operation>` subelement of the `<operations>` element.

Table 13–4 Subelement of the <operations> Element

Element Name	Description
<operation>	Specifies client-side quality of service configuration for a particular operation provided by the referenced Web service. The configuration appears within this element's `<runtime>` subelement. The `<runtime>` subelement is described in Table 13–5. This `<operation>` element has these attributes: ▪ `name`—associates the contained quality of service configuration to a specific operation. The value of the attribute must match the operation name from the WSDL. ▪ `inputName`—contains the input name of the operation from the WSDL. It is required only if the `name` attribute cannot be used to uniquely identify the operation. ▪ `outputName`—contains the output name of the operation from the WSDL. It is required only if the `name` and `input` attributes cannot be used to uniquely identify the operation.

Table 13–5 describes the `<runtime>` subelement of the `<operation>` element.

Table 13–5 Subelement of the <operation> Element

Element Name	Description
<runtime>	Contains client-side quality of service configuration for individual operations within the port. Each child element contains configuration for one of the quality of services features (security, reliability, and/or auditing).

Table 13–6 describes the `name` and `value` subelements of the `<stub-property>` and `<call-property>` elements.

Table 13–6 Subelements of <stub-property> and <call-property> Elements

Element Name	Description
<name>	Defines the name of any property supported by the JAX-RPC `Call` or `Stub` implementation. See the output of the Javadoc tool for the valid properties for `javax.xml.rpc.Call` and `javax.xml.rpc.Stub`.

Table 13–6 (Cont.) Subelements of <stub-property> and <call-property> Elements

Element Name	Description
<value>	Defines a JAX-RPC property value that should be set on a `Call` object or a `Stub` object before it is returned to the Web service client.

Adding JAX-RPC Handlers to Deployment Descriptors

J2EE Web service clients can support JAX-RPC handlers to provide additional message processing facilities for Web service endpoints. For example, you can use a handler to process a SOAP message.

You must enter the handler information as a subelement of `<service-ref>` in a J2EE Web service client's deployment descriptor. The `<handler>` element encapsulates this information. For more information on client-side handlers and registering them with the deployment descriptor, see "Client-Side JAX-RPC Handlers" on page 15-4.

Writing J2EE Web Service Client Code

This section describes some of the common code that allows a J2EE component to access a Web service. At runtime, all J2EE Web service clients use a standard JNDI lookup to find Web services. The following steps describe the general pattern for coding a JNDI lookup that could be used within a servlet, EJB, or a JSP.

1. Create the initial JNDI context.

   ```
   Context ic = new InitialContext();
   ```

   The OC4J container sets up the initial context properties.

2. Locate the service using the `lookup` method from the initial context. The `comp/env/service/MyHelloServiceRef` in Example 13–5 provides the service reference. The JNDI call returns a reference to a `service` object.

   ```
   Service service = (Service)
   ic.lookup("java:comp/env/service/MyHelloServiceRef");
   ```

   The client always accesses the service implementation by using a JNDI lookup. This lookup returns a container-managed service reference. This allows the container to intervene and provide the client with additional service functionality, such as logging, security, and management.

3. Get a handle to the service port using the `getPort` method on the container-managed service object. Cast the return value to the interface type.

   ```
   HelloInterface helloPort = (HelloInterface) service.getPort(portQName,
   oracle.demo.hello.HelloInterface.class);
   ```

   Note that this step assumes that a `QName` has already been defined. For example:

   ```
   QName portQName = new QName("http://hello.demo.oracle/", "HelloInterfacePort");
   ```

   Instead of `getPort`, the client can make a DII Web service call by using the `service` object to get a handle on the `Call` object.

   ```
   Call call = service.createCall(new QName("http://hello.demo.oracle/",
   "HelloInterfacePort");
   ```

4. Call a method on the remote object.

   ```
   resultFromService = helloPort.sayHello(name);
   ```

Example 13–5 illustrates code that a servlet or JSP Web service client can use to look up a Web service.

Example 13–5 Servlet or JSP Code to Look Up a Web Service

```
public String consumeService (String name)
{
   ......
   Context ic = new InitialContext();
   Service service =
(Service)ic.lookup("java:comp/env/service/MyHelloServiceRef");
   // declare the qualified name of the port, as specified in the wsdl
   QName portQName= new QName("http://hello.demo.oracle/","HelloInterfacePort");
   //get a handle on that port : Service.getPort(portQName,SEI class)
   HelloInterface helloPort =
(HelloInterface)
service.getPort(portQName,oracle.demo.hello.HelloInterface.class);
   //invoke the operation : sayHello()
   resultFromService = helloPort.sayHello(name);
   .....
}
```

Configuring a J2EE Web Service Client for a Stateful Web Service

J2EE Web service clients can be configured, either by using configuration files or programmatically, to consume stateful Web services.

- Configuring a J2EE Client with Configuration Files
- Configuring a J2EE Client Programmatically

See "Exposing Java Classes as a Stateful Web Service" on page 6-7 for more information on stateful Web services.

Configuring a J2EE Client with Configuration Files

A J2EE client can be configured to consume stateful Web services by editing the `<service-ref-mapping>` clause of the appropriate Oracle-proprietary deployment descriptor (either `orion-web.xml`, `orion-ejb-jar.xml`, or `orion-application-client.xml`).

Within the `<service-ref-mapping>` clause, add a `<stub-property>` element with its `<name>` sub-element set to the `javax.xml.rpc.session.maintain` property and its `<value>` sub-element set to `true`.

The value of the J2EE standard property `javax.xml.rpc.session.maintain` indicates to the client whether it wants to participate in a session with a service endpoint. If this property is set to `true`, the client indicates that it wants the session to be maintained.

Example 13–6 illustrates a Web service client configuration for a stateful Web service. The definition of the `<stub-property>` allows the client to participate in a session with the port identified by the `CycleCounterInterface` service endpoint. The `<stub-property>` element, with its setting for `javax.xml.rpc.session.maintain`, is highlighted in bold.

Example 13–6 Configuration for a Client Participating with a Stateful Web Service

```
    <service-ref-mapping name="service/CycleCounter">
        <port-info>
```

```
<service-endpoint-interface>test.oracle.stateful.CycleCounterInterface</service-en
dpoint-interface>
          <!-- set the javax.xml.rpc.session.maintain property to true for a
stateful client -->
                <stub-property>
                     <name>javax.xml.rpc.session.maintain</name>
                     <value>true</value>
                </stub-property>
                <stub-property>
                     <name>javax.xml.rpc.service.endpoint.address</name>
                     <value>http://%J2EE_HOST%:%HTTP_
PORT%/testsfWS-session/testsfWS-session</value>
                 </stub-property>
          </port-info>
     </service-ref-mapping>
```

Configuring a J2EE Client Programmatically

A J2EE client can be configured programmatically to consume stateful Web services. To do this, ensure that the client participates in the session by setting the `SESSION_MAINTAIN_PROPERTY` runtime property (`javax.xml.rpc.session.maintain`) to `true` either on the stub, the DII call, or the endpoint client instance.

For example, you can set the value of this property inside the generated implementation `_port` of `javax.xml.rpc.Stub`:

```
((Stub)__port)._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, Boolean.valueOf
(maintainSession));
```

Instead of setting this property directly, OracleAS Web Services provides a helpful wrapper class with a `setMaintainSession(boolean)` method. When this method is set to `true` the session is maintained. The wrapper takes care of setting the property inside of the client. For example, in the client code, you can enter the following:

```
HttpSoap11Client c = new HttpSoap11Client(); // client wrapper class
c.setMaintainSession(true);
```

Configuring a J2EE Web Service Client to Make JMS Transport Calls

You can statically configure the J2EE client to make JMS transport calls. To do this, add a `<service-ref-mapping>` clause to the appropriate Oracle-proprietary J2EE client deployment descriptor file for your Web service (`orion-web.xml`, `orion-ejb-jar.xml`, or `orion-application-client.xml`). Within the clause, configure a `<stub-property>` element with `name` and `value` attributes for each of these items.

- ReplyTo queue—Enter a `<stub-property>` element with the `name` attribute set to the `ReplyToQueueName` API (`oracle.webservices.transport.ReplyToQueueName`) and the `value` attribute set to the JNDI name of the ReplyTo queue.
- ReplyTo factory name—Enter a `<stub-property>` element with the `name` attribute set to the `ReplyToFactoryName` API (`oracle.webservices.transport.ReplyToFactoryName`) and the `value` attribute set to the JNDI name of the ReplyTo factory.
- service endpoint address—Enter a `<stub-property>` element with `name` attribute set to the service endpoint address API

(`javax.xml.rpc.service.endpoint.address`) and the `value` attribute set to the service endpoint interface file.

Example 13–7 illustrates a sample configuration.

Example 13–7 J2EE Client Configuration for JMS Transport Calls

```
<service-ref-mapping name="service/MyJMSService">
     <stub-property>
        <name>oracle.webservices.transport.ReplyToQueueName</name>
        <value>jms/receiverQueue</value>
     </stub-property>
     <stub-property>
        <name>oracle.webservices.transport.ReplyToFactoryName</name>
        <value>jms/receiverQueueConnectionFactory</value>
     </stub-property>
     <stub-property>
        <name>javax.xml.rpc.service.endpoint.address</name>
        <value>/bank/soap12bank</value>
     </stub-property>
</service-ref-mapping>
```

Enabling Chunked Data Transfer for HTTP 1.1

OracleAS Web Services permits the chunked transfer encoding of messages when the protocol is HTTP 1.1. Chunked data transfer can be invoked on J2SE stub, J2EE stub and DII Web service clients.

Chunking can increase performance by breaking the payload into smaller pieces. These pieces can be sent over the wire faster than one large payload. Chunked transfer encoding includes all of the information that the recipient needs to verify that it has received the entire message. Chunked transfer encoding happens at the transport level; it is not detected or handled by the invoker of a Web services call or the server.

The following properties in the `oracle.webservices.ClientConstants` class can be set on the `Stub` or `Call` object to enable chunking and set the chunk size.

- `DO_NOT_CHUNK`—if this property is not set, or set to `true`, then chunking is turned off by default. If this property is set to `false`, then chunking is enabled.
- `CHUNK_SIZE`—sets the chunk size in bytes. If this property is not set, then the default chunk size is 4096 bytes.

Example 13–8 illustrates setting the chunking and chunk size property in client proxy stub code.

Example 13–8 Stub Code to Set Data Chunk Size

```
import oracle.webservices.ClientConstants
...
((OracleStub)port)._setProperty(ClientConstants.DO_NOT_CHUNK (true));
((OracleStub)port)._setProperty(ClientConstants.CHUNK_SIZE (1024));
...
```

Example 13–9 illustrates using the `DO_NOT_CHUNK` and `CHUNK_SIZE` properties in DII client code to set the chunk size to 1024 bytes.

Example 13–9 DII Client Code to Set Data Chunk Size

```
import oracle.webservices.ClientConstants
...
```

```
ServiceFactory factory = ServiceFactory.newInstance();
Service service = factory.createService(new
QName("http://whitemesa.net/wsdl/rpc-lit-test", "tns" ) );
QName stringType = new QName( "http://www.w3.org/2001/XMLSchema", "string");
Call call = service.createCall();
...
call.setProperty(ClientConstants.DO_NOT_CHUNK (false));
call.setProperty(ClientConstants.CHUNK_SIZE (1024));
...
```

Setting a Character Encoding for a SOAP Message

By default, a J2EE client (either static stub or DII) assembled under OracleAS Web Services sends a request message with a SOAP envelope encoded with UTF-8 characters. To override this behavior, you can set the following Oracle proprietary property:

```
oracle.webservices.ClientConstants.CHARACTER_SET_ENCODING
```

You can apply this property to the `javax.xml.rpc.Stub` or `javax.xml.rpc.Call` object with the `setProperty` method.

The value of the `CHARACTER_SET_ENCODING` property can be of type `java.lang.String` or `java.nio.charset.Charset`. The set of supported character encodings depends on the underlying Java Virtual Machine (JVM). Use the `Charset.availableCharsets` method to return the list of character encodings that are supported by your JVM. for more information on the `Charset.availableCharsets` method, see the output of the Javadoc tool for the `java.nio.charset.Charset` class.

This property can also be used for J2SE Web service clients.

Example 13–10 illustrates Stub client code that sets `Shift_JIS` as the character encoding that will be used by the SOAP envelope.

Example 13–10 Setting Shift_JIS Characters for a SOAP Envelope on a Stub Client

```
include oracle.webservices.ClientConstants
...
((OracleStub)port)._setProperty(ClientConstants.CHARACTER_SET_ENCODING, "Shift_
JIS");
...
```

Example 13–11 illustrates DII client code that sets `Shift_JIS` as the character encoding that will be used by the SOAP envelope.

Example 13–11 Setting Shift_JIS Characters for a SOAP Envelope on a DII Client

```
include oracle.webservices.ClientConstants
...
ServiceFactory factory = ServiceFactory.newInstance();
Service service = factory.createService(new URL("path to wsdl"),
new QName("service namespace", "service name" ) );
Call call = service.createCall();
call.setProperty(ClientConstants.CHARACTER_SET_ENCODING, Charset.forName("Shift_
JIS"));
...
```

Packaging a J2EE Client

JDeveloper creates a standard packaging for Web application and EJB client files. This section describes that packaging structure in case you need to customize the contents of the client EAR file.

- Packaging a Servlet or Web Application Client
- Packaging an EJB Client

Packaging a Servlet or Web Application Client

This section describes the packaging of servlet or Web application clients. The values for a number of elements in the deployment descriptors reflect the names of the files and their storage position in the EAR file. If you change the content of the EAR file, you might need to change the content of the deployment descriptors.

- Packaging Structure for Servlet or Web Application Clients
- Relationship Between Deployment Descriptors and Servlet or Web Application Client EAR Files

Packaging Structure for Servlet or Web Application Clients

Servlet or Web application clients are packaged in an EAR file with the name `<ear_file_name>.ear`. At the top level, the EAR file contains a `META-INF` directory for the manifest file and the `application.xml` file and `<war_file_name>.war` file for the servlet or Web application files, the JAX-RPC mapping file, the WSDL file, and the deployment descriptors. Example 13–12 illustrates the standard package structure of the EAR file.

Example 13–12 Structure of a Servlet or Web Application Client EAR File

```
./META-INF
    ./MANIFEST.MF
    ./application.xml
./<war file>.war
    ./WEB-INF/
            /orion-web.xml
            /web.xml
            /wsdl/<wsdl file name>.wsdl
            /<mapping file>.xml
            /classes
                 /class files
            /lib
                 /.jar files
    ./*.jsp or html files
```

Relationship Between Deployment Descriptors and Servlet or Web Application Client EAR Files

This section identifies the relationships between the J2EE standard deployment descriptor `web.xml`, the OC4J deployment descriptor for servlets or Web applications `orion-web.xml`, and the packaging structure of the client EAR file. These relationships are important because if you edit the structure or contents of the client EAR file, you might have to edit the content of the deployment descriptors.

The client information is contained in the `<service-ref>` element in `web.xml`. This element contains information about the Web service that can be looked up and consumed from inside a servlet or JSP. For example, it contains the locations for the

WSDL (<wsdl-file>), the JAX-RPC mapping file (<jaxrpc-mapping-file>), the service interface used for JNDI lookup (<service-ref-name>), the service interface class (<service-interface>), and the service endpoint interface (<service-endpoint-interface>). Note that the <service-ref-name> in web.xml also appears as an attribute in the <service-ref-mapping> element in orion-web.xml. If you change the names and locations of any of these items in the EAR, then you must make the corresponding changes in the deployment descriptors.

See "Adding J2EE Web Service Client Information to Deployment Descriptors" on page 13-4 for more information on the <service-ref> and <service-ref-mapping> elements and their subelements.

Example 13–13 lists the contents of web.xml for a servlet or Web application client. The <service-ref> element is highlighted in bold.

Example 13–13 web.xml Contents for a Servlet or Web Application Client

```
<web-app>
  <servlet>
    <servlet-name>consumer</servlet-name>
    <servlet-class>oracle.ServiceConsumerServlet</servlet-class>
  </servlet>
  <servlet-mapping>
    <servlet-name>consumer</servlet-name>
    <url-pattern>/consumer</url-pattern>
  </servlet-mapping>
  <service-ref>
    <service-ref-name>service/MyHelloServiceRef</service-ref-name>
    <service-interface>javax.xml.rpc.Service</service-interface>
    <wsdl-file>WEB-INF/wsdl/HelloService.wsdl</wsdl-file>

<jaxrpc-mapping-file>WEB-INF/HelloService-java-wsdl-mapping.xml</jaxrpc-mapping-fi
le>
    <service-qname
xmlns:service-qname_ns__="http://hello.demo.oracle/">service-qname_ns__
:HelloService</service-qname>
        <port-component-ref>

<service-endpoint-interface>oracle.demo.hello.HelloInterface</service-endpoint-int
erface>
        </port-component-ref>
  </service-ref>
</web-app>
```

Example 13–14 lists the contents of OC4J proprietary orion-web.xml deployment descriptor for Web applications and servlets. The <service-ref-mapping> element is highlighted in bold.

Example 13–14 orion-web.xml Contents for a Client-Side Servlet or Web Application

```
<orion-web-app
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:noNamespaceSchemaLocation="http://xmlns.oracle.com/oracleas/schema/orion-web-1
0_0.xsd">
        <service-ref-mapping name="service/MyHelloServiceRef">
                        <!-- stub proprty applicable across all ports -->
                        <stub-property>

<name>javax.xml.rpc.service.endpoint.address</name>
```

```
<value>http://localhost:8888/hello/HelloService</value>
                        </stub-property>
        </service-ref-mapping>
</orion-web-app>
```

Packaging an EJB Client

This section describes the packaging of EJB clients. The values for a number of elements in the deployment descriptors reflect the names of the files and their storage position in the EAR file. If you change the content of the EAR file, you might need to change the content of the deployment descriptors.

- Package Structure for EJB Application Clients
- Relationship Between Deployment Descriptors for EJB Application Clients

Package Structure for EJB Application Clients

EJB clients are packaged in an EAR file with the name `<ear_file_name>.ear`. At the top level, the EAR file contains a `META-INF` directory for the manifest file and the `application.xml` file, the EJB class files, and `<ejb_jar_file_name>.jar` file. The JAR file contains the JAR manifest file, the JAX-RPC mapping file, the WSDL file, and the deployment descriptors. Example 13–15 illustrates the packaging structure of an EJB client EAR file.

Example 13–15 Package Structure for a Client-Side EJB Application EAR File

```
./META-INF
     ./MANIFEST.MF
     ./application.xml
./<ejb jar file name>.jar
     ./class files
     ./META-INF/
          /MANIFEST.MF
          /ejb-jar.xml
          /orion-ejb-jar.xml
          /wsdl/<wsdl file name>.wsdl
          /<mapping file>.xml
```

Relationship Between Deployment Descriptors for EJB Application Clients

This section identifies the relationships between the J2EE standard deployment descriptor `ejb-jar.xml`, the OC4J deployment descriptor for servlets or Web applications `orion-ejb-jar.xml`, and the packaging structure of the EJB client EAR file. These relationships are important because if you edit the structure or contents of the client EAR file, you might have to edit the content of the deployment descriptors.

The client information is contained in the `<service-ref>` element in `ejb-jar.xml`. This element contains information about the servlet or Web application that can be used as a Web service client. For example, it contains the locations for the WSDL (`<wsdl-file>`), the JAX-RPC mapping file (`<jaxrpc-mapping-file>`), the service interface used for JNDI lookup (`<service-ref-name>`), the service interface class (`<service-interface>`), and the service endpoint interface (`<service-endpoint-interface>`). Note that the `<service-ref-name>` in `ejb-jar.xml` also appears as an attribute in the `<service-ref-mapping>` element in `orion-ejb-jar.xml`. If you change the names and locations of any of these items in the EAR, then you must make the corresponding changes in the deployment descriptors.

See "Adding J2EE Web Service Client Information to Deployment Descriptors" on page 13-4 for more information on the `<service-ref>` and `<service-ref-mapping>` elements and their subelements.

Example 13–16 lists the contents of `ejb-jar.xml` for an EJB client. The `<service-ref>` element is highlighted in bold.

Example 13–16 ejb-jar.xml Contents for a Client-Side EJB Application

```
<ejb-jar>
  <display-name>serviceConsumerEJB</display-name>
  <enterprise-beans>
    <session>
        <ejb-name>ServiceConsumer</ejb-name>
        <home>oracle.ServiceConsumerHome</home>
        <remote>oracle.ServiceConsumerRemote</remote>
        <ejb-class>oracle.ServiceConsumerBean</ejb-class>
        <session-type>Stateless</session-type>
        <transaction-type>Container</transaction-type>
        <service-ref>
                <service-ref-name>service/MyHelloService</service-ref-name>
                <service-interface>javax.xml.rpc.Service</service-interface>
                <wsdl-file>META-INF/wsdl/HelloService.wsdl</wsdl-file>

<jaxrpc-mapping-file>META-INF/HelloService-java-wsdl-mapping.xml</jaxrpc-mapping-f
ile>

<service-qnamexmlns:ns="http://hello.demo.oracle/">ns:HelloService</service-qname>
                <port-component-ref>

<service-endpoint-interface>oracle.demo.hello.HelloInterface</service-endpoint-int
erface>
                </port-component-ref>
        </service-ref>
    </session>
  </enterprise-beans>
</ejb-jar>
```

Example 13–17 lists the contents of OC4J proprietary `orion-ejb-jar.xml` deployment descriptor for Web applications and servlets. The `<service-ref-mapping>` element is highlighted in bold.

Example 13–17 orion-ejb-jar.xml Contents for a Client-Side EJB Application

```
<orion-ejb-jar>
    <enterprise-beans>
        <session-deployment name="ServiceConsumer">
            <service-ref-mapping name="service/MyHelloService">
                <stub-property>
                    <name>javax.xml.rpc.service.endpoint.address</name>
                    <value>http://localhost:8888/hello/HelloService</value>
                </stub-property>
            </service-ref-mapping>
        </session-deployment>
    </enterprise-beans>
</orion-ejb-jar>
```

Limitations

See "Assembling a J2EE Web Service Client" on page C-7.

Additional Information

For more information on:

- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".
- assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".
- building J2SE clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services"
- jar files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- how to write clients to access Web services secured on the transport level, see "Adding Transport-level Security for Web Services Based on EJBs" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

14

Assembling a J2SE Web Service Client

This chapter provides information on developing a Web services client for the J2SE platform. This chapter has the following sections.

Understanding J2SE Web Service Clients

The J2SE client, unlike the J2EE client, is responsible for much of the underlying work of looking up the service, and creating and maintaining the instances of classes that access the Web service. Since developers cannot rely on the container, they must create and manage their own services, and ensure the availability of all runtime environments needed to access the Web service.

The following sections describe static stub clients and Dynamic Invocation Interface (DII) clients.

Using Static Stub Clients

The WebServicesAssembler command `genProxy` generates static stubs from a supplied WSDL document. The generated stubs implement the `javax.xml.rpc.Stub` interface and a service endpoint interface. Additionally, the generated stubs are specifically bound to the HTTP transport and SOAP protocol. You can instantiate the generated stubs and invoke their methods directly to send requests to the associated Web service.

In addition, WebServicesAssembler generates a client utility class that demonstrates how a client leverages the static stubs to interact with a Web service. The name of the utility client class is *<WSDL_port_name>*`Client.java`. This class handles all steps necessary for creating a stub instance. You may want to instantiate the utility client and use it to invoke the remote service's operations.

Note: The client utility class file is regenerated every time WebServicesAssembler is executed, it is strongly recommended that you place your own code in a separate file. Otherwise, you will lose your changes.

Using the Web Service Dynamic Invocation Interface

The JAX-RPC Dynamic Invocation Interface supports the invocation of a remote Web service operation even if the name of the service or the signature of the remote method is unknown prior to runtime.

Support for DII is provided through OC4J's implementation of the `javax.xml.rpc.Call` interface. The `javax.xml.rpc.Service` class acts as a factory for `Call` instances by using the overloaded `javax.xml.rpc.Service.createCall()` method. Once created, the various getters and setters that the `Call` interface provides are used to configure the port type, the operation name, the service endpoint address, and other attributes required for executing the remote method.

For examples of using DII clients to invoke Web services, see "Using Dynamic Invocation Interface to Invoke Web Services" on page C-11.

Prerequisites

Before you begin, provide the following files and information.

- Supply the URI to the WSDL you want to employ to generate the client. This chapter uses the WSDL file described in "Sample WSDL File" on page 14-3.
- Decide on the destination location for generated artifacts.
- Decide on a package name for the client files.

How to Assemble a J2SE Web Service Client with a Static Stub

You can use WebServicesAssembler to create a J2SE Web service client using static stubs. To create the static stub, follow these steps.

1. Provide the URI to the WSDL, the name of the output directory, the package name, and the other information and files described in the Prerequisites section as input to the WebServicesAssembler `genProxy` command. For example:

   ```
   java -jar wsa.jar -genProxy
                     -output build/src/client/
                     -wsdl http://localhost:8888/hello/HelloService?WSDL
                     -packageName oracle.demo.hello
   ```

   This command generates the client proxies and stores them in `build/src/client`. The client application uses the stub to invoke operations on a remote service. For more information on the required and optional arguments to `genProxy`, see "genProxy" on page 17-30.

2. Use the client utility class file created by `genProxy` as your application client, or use it as a template to write your own client code. The client utility class file is one of a number of files created by `genProxy`.

   You can also use the client utility class file to test your endpoint. Example 14–2, "HelloInterfacePortClient.java Listing" on page 14-5, illustrates the client utility class file created in this example. For more information about this file, see "Writing Web Service Client Applications" on page 14-4.

3. Compile the client files and put them in the classpath.

   List the appropriate JARs on the classpath before compiling the client. Table A–2, " Classpath Components for a Client Using a Client-Side Proxy" lists all of the JAR files that can possibly be used on the client classpath. As an alternative to listing individual JARs, you can include the client-side JAR, `wsclient_extended.jar`

on the client classpath. This JAR file contains all the classes necessary to compile and run a Web service client. The classes are from the individual JAR files listed in Table A–2. See "Setting the Web Service Proxy Client Classpath" on page A-2 for more information on `wsclient_extended.jar` and the client classpath.

4. Run the J2SE client from the command line.

Ant Tasks for Generating a J2SE Web Service Client

The current release provides Ant tasks for Web services development. The following code sample shows how the WebServicesAssembler `genProxy` command can be rewritten as an Ant task.

```
<oracle:genProxy
            wsdl="http://localhost:8888/hello/HelloService?WSDL"
            output="build/src/client"
            packageName="oracle.demo.hello"/>
```

Sample WSDL File

Example 14–1 contains a partial listing of the `HelloService.wsdl` used to generate the client. One of the files generated from this WSDL is the client utility class file listed in Example 14–2.

This partial listing illustrates a number of entries in the WSDL file that are employed in the generation of the client utility class file. For example:

- The name of the client utility class file, `HelloInterfacePortClient.java`, is derived from the value of the `<port name>` element.
- The operation name, `sayHello`, which appears under the `<portType>` element, becomes a method in the client utility class file.
- The parameter and data type belonging to `sayHello` is defined by the `complexType` defining the `sayHello` request:

```
<complexType name="sayHello">
    <sequence>
          <element name="name" nillable="true" type="string"/>
    </sequence>
</complexType>
```

The preceding elements appear in bold in the partial listing of `HelloService.wsdl`.

Example 14–1 WSDL Fragment, With Elements Used in the Client Utility Class File

```
<definitions
    ...
  >
    <types>
        <schema targetNamespace="http://hello.demo.oracle/" ...
xmlns="http://www.w3.org/2001/XMLSchema"
           ...
            <complexType name="sayHello">
                <sequence>
                    <element name="name" nillable="true" type="string"/>
                </sequence>
            </complexType>
            <complexType name="sayHelloResponse">
                <sequence>
                    <element name="result" nillable="true" type="string"/>
                </sequence>
```

```
            </complexType>
            <element name="sayHelloElement" type="tns:sayHello"/>
            <element name="sayHelloResponseElement" type="tns:sayHelloResponse"/>
        </schema>
    </types>
    <message name="HelloInterface_sayHelloResponse">
        <part name="parameters" element="tns:sayHelloResponseElement"/>
    </message>
    <message name="HelloInterface_sayHello">
        <part name="parameters" element="tns:sayHelloElement"/>
    </message>
    <portType name="HelloInterface">
        <operation name="sayHello">
            <input message="tns:HelloInterface_sayHello"/>
            <output message="tns:HelloInterface_sayHelloResponse"/>
        </operation>
    </portType>
    <binding name="HelloInterfacePortBinding" type="tns:HelloInterface">
        <soap:binding style="document"
transport="http://schemas.xmlsoap.org/soap/http"/>
        <operation name="sayHello">
            <soap:operation soapAction="http://hello.demo.oracle/:sayHello"/>
            <input>
                <soap:body use="literal" parts="parameters"/>
            </input>
            <output>
                <soap:body use="literal" parts="parameters"/>
            </output>
        </operation>
    </binding>
    <service name="HelloService">
        <port name="HelloInterfacePort" binding="tns:HelloInterfacePortBinding">
            <soap:address location="HelloService"/>
        </port>
    </service>
</definitions>
```

Writing Web Service Client Applications

The `genProxy` command generates a client utility class file that enables you to invoke Web service methods. You can use this file as your application client, or use it as a template to write your own application client code.

> **Note:** The client utility class file is regenerated each time you run `genProxy`. If you add code to this file for testing purposes, then your changes will be lost if you regenerate the proxy. For production code, your client code should exist outside of this utility class.

The command derives the name of the file by appending the suffix `Client` to the port name. For example, for the `HelloInterfacePort` port name, `genProxy` generates the `HelloInterfacePortClient.java` file. Example 14–2, "HelloInterfacePortClient.java Listing" on page 14-5 illustrates the sample client utility class file generated by `genProxy`.

The client utility class serves as a proxy to the Web service implementation. The client-side proxy code constructs a SOAP request and marshals and unmarshals parameters for you. Using the proxy classes saves you the work of creating SOAP

requests and data marshalling for accessing a Web service or processing Web service responses.

The most important part of the client utility class file is the factory code for creating `javax.xml.rpc.Service` objects and obtaining the operations available on the service. The `Service` object acts as an instance of the generated stub class.

Note the following lines of code in the client utility class file:

```
public HelloInterfaceClient() throws Exception {
    ServiceFactory factory = ServiceFactory.newInstance();
    _port = ((HelloService)factory.loadService
                (HelloService.class)).getHelloInterfacePort();
}
```

If you write your own application client, you must supply this code. The following steps describe the code.

1. Instantiate a new `javax.xml.rpc.ServiceFactory` instance or use an existing instance.

   ```
   ServiceFactory factory = ServiceFactory.newInstance();
   ```

2. Load the service for a particular service endpoint interface using the `loadService` method. This returns an object of type `Service` that also implements the requested service endpoint interface.

   ```
   (HelloService)factory.loadService(HelloService.class)
   ```

   In this example, the returned `Service` is cast to the service endpoint interface `HelloService`.

3. Use the `get...()` method to get the desired port. The ellipsis ("...") represents the value of the `port name` element in the WSDL.

   ```
   HelloService.getHelloInterfacePort();
   ```

   In this example, the method name is `getHelloInterfacePort()`, where `HelloInterfacePort` is the `port name` in the WSDL. The method returns a Java implementation for `HelloInterfacePort`.

Example 14–2 displays the client utility class file, `HelloInterfacePortClient.java`, which was generated from the `HelloService.wsdl` in Example 14–1 by the `genProxy` command. The lines of code that create the `Service` objects and obtain the operations available on the service appear in bold.

Also note the presence of the `SESSION_MAINTAIN_PROPERTY` in this example. This property is used to alert the client that the Web service is stateful. You will want to maintain the session when the client is operating in conjunction with a server side, stateful Web service. By maintaining the session, subsequent requests to the service are faster.

Example 14–2 HelloInterfacePortClient.java Listing

```
import oracle.webservices.transport.ClientTransport;
import oracle.webservices.OracleStub;
import javax.xml.rpc.ServiceFactory;
import javax.xml.rpc.Stub;

public class HelloInterfacePortClient {
    private HelloInterface _port;
```

```
    public HelloInterfacePortClient() throws Exception {
        ServiceFactory factory = ServiceFactory.newInstance();
        _port =((HelloService)factory.loadService(
           HelloService.class)).getHelloInterfacePort();
    }

    /**
     * @param args
     */
    public static void main(String[] args) {
        try {
            HelloInterfacePortClient myPort = new HelloInterfacePortClient();
            System.out.println("calling " + myPort.getEndpoint());
            // Add your own code here

        } catch (Exception ex) {
            ex.printStackTrace();
        }
    }

    /**
     * delegate all operations to the underlying implementation class.
     */
    // sayHello
    public String sayHello(String name) throws java.rmi.RemoteException {
        return _port.sayHello(name);
    }

    /**
     * used to access the JAX-RPC level APIs
     * returns the interface of the port instance
     */
    public oracle.demo.hello.HelloInterface getPort() {
        return _port;
    }

    public String getEndpoint() {
        return (String) ((Stub)
_port)._getProperty(Stub.ENDPOINT_ADDRESS_PROPERTY);
    }

    public void setEndpoint(String endpoint) {
        ((Stub) _port)._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY,
endpoint);
    }

    public String getPassword() {
        return (String) ((Stub) _port)._getProperty(Stub.PASSWORD_PROPERTY);
    }

    public void setPassword(String password) {
        ((Stub) _port)._setProperty(Stub.PASSWORD_PROPERTY, password);
    }

    public String getUsername() {
        return (String) ((Stub) _port)._getProperty(Stub.USERNAME_PROPERTY);
    }

    public void setUsername(String username) {
```

```
        ((Stub) _port)._setProperty(Stub.USERNAME_PROPERTY, username);
    }

    public void setMaintainSession(boolean maintainSession) {
        ((Stub) _port)._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, new
Boolean(maintainSession));
    }

    public boolean getMaintainSession() {
        return ((Boolean) ((Stub)
_port)._getProperty(Stub.SESSION_MAINTAIN_PROPERTY)).booleanValue();
    }

   /**
     * returns the transport context
     */
    public ClientTransport getClientTransport() {
        return ((OracleStub) _port).getClientTransport();
    }
}
```

Enabling Chunked Data Transfer for HTTP 1.1

OracleAS Web Services permits the chunked transfer encoding of messages when the protocol is HTTP 1.1. Chunked data transfer can be invoked on J2SE stub, J2EE stub and DII Web service clients.

For more information on how to enable this feature, see "Enabling Chunked Data Transfer for HTTP 1.1" on page 13-14.

Setting a Character Encoding for a SOAP Message on a J2SE Client

By default, a client assembled under Oracle Application Server Web Services sends a request message with a SOAP envelope encoded with UTF-8 characters. To override this behavior, you can set the following Oracle proprietary property:

`oracle.webservices.ClientConstants.CHARACTER_SET_ENCODING`

This property can be used to set the character encoding for a J2SE client or a J2EE client. For more information on how to use this property, see "Setting a Character Encoding for a SOAP Message" on page 13-15.

Setting Cookies in a Client Stub

A client stub can be used to set the cookies used in an HTTP request.

To do this, follow these general steps:

1. Construct a cookie, using the `Cookie` class from the Oracle Applications Server 10*g* `HTTPClient` package.

   The `Cookie` class represents an HTTP cookie. `Cookie` has the following constructor:

   `Cookie (java.lang.String` *`name`*`, java.lang.String` *`value`*`, java.lang.String` *`domain`*`, java.lang.String` *`path`*`, java.util.Date` *`expires`*`, boolean` *`secure`*`)`

   All parameters except *`expires`* are required to the `Cookie` constructor.

2. Set the property `oracle.webservices.ClientConstants.COOKIE_MAP`.

The value of the property is a `java.util.Map` object that contains items and keys of type `HTTPClient.Cookie`.

3. Set the `javax.xml.rpc.session.SESSION_MAINTAIN_PROPERTY` runtime property set to `true`.

   This property alerts the client that the Web service is stateful. If this property is not set to `true`, then the cookies will be ignored.

Example 14–3 illustrates stub code that sets the value of two cookies. The `cookieMap` variable is declared to be of type `java.util.Map` and obtains its contents from a `HashMap`. The `Cookie` constructor is used to define two cookies, `cookie` and `cookie2`. The `cookieMap.put` lines add the cookies to the hashmap. The `Stub.SESSION_MAINTAIN_PROPERTY` is present and set to `true` and the `ClientConstants.COOKIE_MAP` is set to `cookieMap`.

Example 14–3 Setting a Cookie in a Client Stub

```
import HTTPClient.Cookie;
   Map cookieMap = new HashMap();

   Cookie cookie = new Cookie("name", "value", "oracle.com", "/",  null, false);
   Cookie cookie2 = new Cookie("name2", "value2", "oracle.com", "/", null, false);
   cookieMap.put(cookie, cookie);
   cookieMap.put(cookie2, cookie2);

   ((Stub) port)._setProperty(ClientConstants.COOKIE_MAP, cookieMap);
   ((Stub) port)._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, Boolean.TRUE);
...
```

Tool Support for Assembling J2SE Web Service Clients

Oracle JDeveloper enables you to build client applications that use Web services. It supports OC4J J2SE Web service clients by allowing you to create Java stubs from Web service WSDL descriptions. You can use these stubs to access existing Web services. For more information, see the JDeveloper on-line help.

Additional Information

For more information on:

- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".
- assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".
- building J2EE clients, see Chapter 13, "Assembling a J2EE Web Service Client".

- improving performance by data chunking, see "Enabling Chunked Data Transfer for HTTP 1.1" on page 13-14.
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".
- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- how to write clients to access Web services secured on the transport level, see "Adding Transport-level Security for Web Services Based on EJBs" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the JAX-RPC mapping file, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

15

Understanding JAX-RPC Handlers

This chapter provides an overview of working with JAX-RPC message handlers.

Message Handler Overview

SOAP message handlers are used to process messages to and from a Web service. There are two kinds of handlers: client and server.

- Client handlers can intercept messages sent from a client application, the "request", and the corresponding message returned by the service, the "response".
- Server handlers can intercept messages sent to a Web service, the "request", and the corresponding message returned by the service, the "response".

Because handlers gain privileged access to the entire SOAP envelope, they are commonly used for SOAP header processing. Some other common uses for handlers are:

- logging
- auditing
- encryption/decryption

Much of this functionality is provided by the OracleAS Web Services management infrastructure. In many cases, a user-written handler might not be necessary.

For any given Web service or Web service client, there can be zero or more handlers. A collection of handlers constitutes a handler chain. The handler chain is maintained by the JAX-RPC runtime implementation. The default behavior of the runtime implementation is to call each handler in order from the chain. However, a handler can change this processing model based on its implementation of the `javax.xml.rpc.handler.Handler` interface. For example, returning `false` in the `handleRequest` message will halt the runtime from proceeding to the next handler in the chain. Throwing an exception will have a similar effect. For more information on handlers and the handler model, see the JAX-RPC 1.1 specification.

`http://java.sun.com/webservices/jaxrpc/index.jsp`

Writing a JAX-RPC Handler

To build a JAX-RPC handler, implement the `javax.xml.rpc.handler.Handler` interface.

```
package javax.xml.rpc.handler;
public interface Handler{
    public boolean handleRequest(javax.xml.rpc.handler.MessageContext context);
    public boolean handleResponse(javax.xml.rpc.handler.MessageContext context);
    public boolean handleFault(javax.xml.rpc.handler.MessageContext context);
    public void destroy();
    public void init(javax.xml.rpc.handler.HandlerInfo config);
    public javax.xml.namespace.QName[] getHeaders();
}
```

For more information on the `Handler` interface, see the output of the Javadoc tool at the following Web address.

http://java.sun.com/j2ee/1.4/docs/api/javax/xml/rpc/handler/Handler.html

As an alternative to implementing the `Handler` interface, you can extend the `javax.xml.rpc.handler.GenericHandler` class. This class provides default implementations for all of the interface's methods so there is no need to redefine them in your handler implementation.

Configuring a Server-Side JAX-RPC Handler

Handlers are ultimately configured and registered in the Web services deployment descriptor (`webservices.xml`). However, instead of editing the file yourself, you can have WebServicesAssembler generate the proper configuration by specifying the handler classes, that is, classes that implement the `Handler` interface, at development time.

> **Note:** WebServicesAssembler provides Ant tasks that let you configure JAX-RPC message handlers. Handlers cannot be configured by using the WebServicesAssembler command line.

For example, to add server handlers for a Web service described by the WSDL in Example 16–1, you could use the following Ant task. The server handler appears in bold:

```
<oracle:topDownAssemble appName="hello-service"
                  wsdl="Hello.wsdl"
                  input="./classes"
                  output="build"
                  ear="dist/hello-service.ear"
                  packageName="oracle.demo"
                  >
                   <oracle:porttype className="oracle.demo.HelloImpl" />
                   <oracle:handler name="ServerHandler"
                            handlerClass="oracle.demo.ServerHelloHandler"/>
</oracle:topDownAssemble>
```

In this example, the server handler `oracle.demo.ServerHelloHandler` will be configured for the `hello-service` Web service. Any number of handlers can be added by adding `<handler>` tags, each with unique names. The order in which the handler elements are listed is the order in which they will be added to the handler

chain. Although this example is for top down development, handlers can also be added to other Ant tasks using the same `<handler>` tag. The following is a list of Ant tasks that can include the `<handler>` tag. "Configuring Handlers in an Ant Task" on page 17-71 provides more information on configuring handlers.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- genDDs
- genProxy (for client-side generation only)
- jmsAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble

To add client-side handlers, the configuration is almost identical. For more information, see "Client-Side JAX-RPC Handlers" on page 15-4.

Registering JAX-RPC Handlers with webservices.xml

If you use Ant tasks to add handlers while generating your Web service, there should be no need to add handlers to the `webservices.xml` file. If you use the command line or are manually creating a Web service deployment, you can add handlers to `webservices.xml` by adding child elements to the `<port-component>` element. Example 15–1 illustrates a `<port-component>` element with multiple handlers.

Example 15–1 Sample JAX-RPC Handlers in webservices.xml

```
<port-component>
    ...
<handler>
    <handler-name>First Handler</handler-name>
    <handler-class>oracle.xx.AccountTransactionHandler</handler-class>
    <init-param>
       <param-name>test</param-name>
       <param-value>testValue</param-value>
    </init-param>
</handler>
<handler>
    <handler-name>Second Handler</handler-name>
    <handler-class>oracle.xx.NewAccountHandler</handler-class>
</handler>
   ...
</port-component>
```

Table 15–1 describes the `<handler>` subelements that can be used to specify a server-side handler:

Table 15–1 <handler> Subelements for a Server-Side Handler

Subelement	Description
<handler-name>	A unique name that identifies the handler.
<handler-class>	The fully-qualified name of the class to which the handler belongs. The class must implement: `javax.xml.rpc.handler.Handler`.
<init-param>	A subelement containing one *param-name*, *param-value* pair.
	The *param-name*, *param-value* pair represents a single parameter and value that will be passed to the handler's `init` method. There is no limit on the number of `init-param` subelements that can be used in a `<handler>` element.

For more information on the contents of `webservices.xml`, see its schema at the following Web address:

`http://java.sun.com/xml/ns/j2ee/j2ee_web_services_1_1.xsd`

Client-Side JAX-RPC Handlers

On the Web service client, JAX-RPC handlers can intercept and process messages sent from a client application and the corresponding message returned by the service. These handlers can, for example, process the SOAP message. The following sections describe how to register the handlers for use in Web service clients:

- Registering JAX-RPC Handlers for J2EE Web Service Clients
- Registering JAX-RPC Handlers for J2SE Web Service Clients

Registering JAX-RPC Handlers for J2EE Web Service Clients

For J2EE Web service clients, JAX-RPC handler information appears within the `<service-ref>` element in the deployment descriptor for a given J2EE client. The `<service-ref>` element captures all of the service's J2EE client-related information, such as the location of the WSDL and mapping file, the service interface, the ports the service will run on and their related service endpoint interfaces, and so on.

Unlike server-side handlers, client-side handlers are associated with service references (`<service-ref>`) instead of port component references (`<port-component>`). Client-side handlers have a configurable `<port-name>` parameter that associates a handler with the port of the invoked service. When a service endpoint (WSDL port) is invoked, the value of `<port-name>` determines which handler is run.

To register a handler for a J2EE Web service client, enter the handler information in the `<service-ref>` section of its deployment descriptor. The following list identifies the J2EE deployment descriptors for each J2EE component that can act as a Web service client.

- `WEB-INF/web.xml` for a JSP or servlet
- `META-INF/application-client.xml` for an application client
- `META-INF/ejb-jar.xml` for an EJB

Using the handler Element in a J2EE Web Service Client

The `<handler>` element encapsulates the handler information for a J2EE Web service client. Table 15–2 describes the sub-elements that it can use:

Table 15–2 <handler> Subelements for a J2EE Web Service Client Handler

Subelement	Description
<handler-name>	The unique name that identifies the handler.
<handler-class>	The fully-qualified name of the class to which the handler belongs. The class must implement `javax.xml.rpc.handler.Handler`.
<port-name>	The name of the port on which the handler will operate.

Enter the handler information at the end of the `<service-ref>` section, after any port component information. Example 15–2 illustrates a `<service-ref>` tag with two defined handlers. In this example, `First Handler` is associated with the class `oracle.xx.AccountTransactionHandler` and runs on `portA`. `Second Handler` is associated with the class `oracle.xx.NewAccountHandler` and runs on `portB`. `First Handler` runs only if `PortA` is invoked and `Second Handler` runs only if `PortB` is invoked.

Example 15–2 Sample JAX-RPC Handler for a J2EE Client

```
<service-ref>
    <service-ref-name>service/MyHelloServiceRef</service-ref-name>
    ....
    <port-component-ref>
        ....
    </port-component-ref>
 <handler>
         <handler-name>First Handler</handler-name>
         <handler-class>oracle.xx.AccountTransactionHandler</handler-class>
         <port-name>portA</port-name>
 </handler>
 <handler>
         <handler-name>Second Handler </handler-name>
         <handler-class>oracle.xx.NewAccountHandler</handler-class>
         <port-name>portB</port-name>
      </handler>
</service-ref>
```

For more information on the contents of `<service-ref>` element, see the `service-ref` (J2EE client) schema.

`http://java.sun.com/xml/ns/j2ee/j2ee_web_services_client_1_1.xsd`

Registering JAX-RPC Handlers for J2SE Web Service Clients

Client-side JAX-RPC handlers for J2SE clients can be registered using the `genProxy` Ant task for WebServicesAssembler. In Example 15–3, the handler `oracle.demo.ClientHelloHandler` will be available to the J2SE client. Unlike J2EE Web service clients, J2SE clients do not use a deployment descriptor.

Example 15–3 Registering a Handler for a J2SE Web Service Client

```
<oracle:genProxy
            wsdl="http://localhost:8888/hello-service/hello-service?WSDL"
            output="build/src/client"
            packageName="oracle.demo">
            <oracle:handler
                  name="ClientHelloHandler"
                  handlerClass="oracle.demo.ClientHelloHandler" />
```

```
</oracle:genProxy>
```

Limitations

See "Understanding JAX-RPC Handlers" on page C-7.

Additional Information

For more information on:

- processing messages directly, see the SAAJ APIs available from:

  `http://java.sun.com/webservices/saaj/index.jsp`

- OracleAS Web Services extensions to the SAAJ APIs that allow you to work with SOAP 1.2 messages, see "Working with SOAP Messages" on page 4-10.
- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".

  assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".

16

Processing SOAP Headers

This chapter describes the ways in which you can process SOAP headers:

- Processing SOAP Headers with Parameter Mapping
- Processing SOAP Headers by Using Handlers
- Processing SOAP Headers by Using the ServiceLifecycle Interface

Processing SOAP Headers with Parameter Mapping

The WebServicesAssembler tool can be used to map SOAP header blocks defined in a `wsdl:binding` element of a WSDL file to method parameters in the generated service endpoint interface (SEI). This allows the SOAP header blocks to be accessed directly inside methods implementing the service endpoint interface.

Example 16–1 illustrates a simple WSDL that explicitly defines a SOAP header.

Example 16–1 Simple WSDL That Explicitly Defines a SOAP Header

```
<definition xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:tns="http://test.com"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"  xmlns:xs="http://www.w3.
org/2001/XMLSchema"
>
   <types/>
   <message name="HelloHeader">
      <part name="header" type="xs:string"/>
   </message>
   <message name="HelloMessage">
      <part name="body" type="xs:string"/>
   </message>
   message name="HelloMessageResponse"/>
   <portType name="HelloPortType">
      <operation name="sayHello">
         <input message="tns:HelloMessage"/>
         <output message="tns:HelloMessageResponse/>
         </operation>
      </portType>
      <binding name="HelloBinding" type="tns:HelloPortType">
         <soap:binding style="rpc" transport="http://schemas.xmlsoap.
org/soap/http" />
         <operation name="sayHello">
            <input>
               <soap:body use="literal" namespace="http://test.com"/>
               <!--the SOAP header must be defined here -->
               <soap:header message=""tns:HelloHeader" part="header"
use="literal"/>
```

```
         </input>
         <output>
            <soap:body use="literal" namespace="http://test.com"/>
         </output>
      </operation>
   </binding>
   <service name="HelloService">
      <port name="HelloPort" binding="tns:HelloBinding">
         <soap:address
location="http://localhost:8888/hello-service/hello-service"/>
      </port>
   </service>
</definition>
```

The WebServicesAssembler argument for mapping SOAP headers to parameters is `mapHeadersToParameters`. The default for this argument is `true`, so there is no need to explicitly provide it unless you want to suppress the SOAP headers.

You can generate the service endpoint interface with parameter mapping by using either Ant tasks or the WebServicesAssembler tool. The following sample Ant task maps SOAP headers to parameters for the `hello-service` Web service.

```
<oracle:topDownAssemble appName="hello-service"
                  wsdl="Hello.wsdl"
                  input="./classes"
                  output="build"
                  ear="dist/hello-service.ear"
                  packageName="oracle.demo "
                  mapHeadersToParameters="true"
                  >
                  <oracle:porttype className="oracle.demo.HelloImpl" />
/>
```

The following is the WebServicesAssembler command line version of the previous example.

```
java -jar wsa.jar -topDownAssemble
                  -wsdl Hello.wsdl
                  -output build
                  -ear dist/hello-services.ear
                  -mapHeadersToParameters true
                  -packageName oracle.demo
```

Processing SOAP Headers by Using Handlers

JAX-RPC Handlers can be used to process both explicit and implicit SOAP headers. Explicit SOAP headers are those defined in the WSDL document. Example 16–1 illustrates a simple WSDL that defines a SOAP header. Implicit SOAP headers are those that are not necessarily defined in any particular WSDL document, but may be present in a SOAP envelope.

Handlers gain access to a SOAP header using the methods defined in the `javax.xml.rpc.handler.Handler` interface (see the JAX-RPC 1.1 specification available from: `http://java.sun.com/webservices/jaxrpc/index.jsp`). These methods are:

```
boolean handleRequest(MessageContext context);
boolean handleResponse(MessageContext context);
boolean handleFault(MessageContext context);
```

The `context` argument in each of these messages can be used to view the SOAP headers in the SOAP envelope. The following is an example of a handler implementation viewing the headers on a SOAP request:

```
boolean handleRequest(MessageContext context){
      javax.xml.rpc.handler.soap.SOAPMessageContext smc = (javax.xml.rpc.handler.
soap.SOAPMessageContext)context;
      javax.xml.soap.SOAPHeader sh = smc.getSOAPMessage.getSOAPHeader();
      //the SOAPHeader will contain a list of SOAPHeaderElements (header blocks)
      Iterator it = sh.examineAllHeaderElements();
      //iterate through all the SOAP header elements and print their names
      while(it.hasNext()){
            javax.xml.soap.SOAPHeaderElement elem = (SOAPHeaderElement)it.next();
            System.out.println(elem.getElementName().getQualifiedName());
      }
      return true;
}
```

For information on processing messages directly, see the SOAP with Attachments API for Java (SAAJ) at the following Web address:

http://java.sun.com/webservices/saaj/index.jsp

Processing SOAP Headers by Using the ServiceLifecycle Interface

You can manage the life cycle of the service endpoint by implementing the `javax.xml.rpc.server.ServiceLifecycle` interface. The interface has the following methods.

```
void init(Object context);
void destroy();
```

The runtime system will invoke the `init` method and pass a context object. Example 16–2 demonstrates how to use the `javax.xml.rpc.server.ServiceLifecycle` interface to access SOAP headers:

Example 16–2 Using ServiceLifecycle to Access SOAP Headers

```
public class HelloImpl implements HelloPortType,ServiceLifecycle{
      private Object m_context;

      public void sayHello(String body){
            javax.xml.rpc.server.ServletEndpointContext sec =
(ServletEndpointContext)m_context;
            javax.xml.rpc.handler.soap.SOAPMessageContext mc =
(SOAPMessageContext)sec.getMessageContext();
            javax.xml.soap.SOAPHeader sh = mc.getSOAPMessage().getSOAPHeader();
             // from here you can process all the header
             // blocks in the SOAP header.
}

      //this will be called by the runtime system.
      public void init(Object context){
      m_context = context;
      }
      public void destroy(){
      }
}
```

Implementing this interface enables you to process both implicit and explicit SOAP headers, although it is more useful for the implicit headers.

Getting HTTP Headers with the ServiceLifecycle Interface

The `HTTP_SERVLET_REQUEST` property in the `oracle.webservices.ServerConstants` class enables you to access the HTTP message header. This property can be used by a service implementation class to get the HTTP servlet request when the caller of the Web service uses HTTP transport.

To use this property, the service implementation must implement `javax.xml.rpc.server.ServiceLifecyle` and store the `Object` passed into the `init` method which is an instance of `javax.xml.rpc.server.ServletEndpointContext`.

When a method in the service implementation class is invoked, the `ServletEndpointContext.getMessageContext` method returns a `javax.xml.rpc.handler.MessageContext`. The `MessageContext.getProperty` method can use `HTTP_SERVLET_REQUEST` as a property name. The returned object is an instance of `javax.servlet.http.HttpServletRequest`.

Example 16–3 illustrates how to get an HTTP header to obtain the IP address. In the example, the `HelloImpl` class implements the `ServiceLifecycle` interface. In this case, the `context` object passed to the `init` method is cast to the `ServletEndpointContext` object. The `destroy` method destroys the service lifecycle. In the implementation of the `getIPAddress` method, the `getMessageContext` method pulls the message context from the `ServletEndpointContext` object. The `getProperty` method uses the `HTTP_SERVLET_REQUEST` property to return the request as an `HttpServletRequest` object. The `getRemoteAddr` method returns the IP address.

Example 16–3 Getting an HTTP Header

```
public class HelloImpl implements ServiceLifecycle  {
   ServletEndpointContext m_context;
   public void init(Object context) throws ServiceException {
       m_context = (ServletEndpointContext)context;
   }

   public void destroy() {
    }

   public String getIPAddress(){
      HttpServletRequest request = (HttpServletRequest)m_context.
          getMessageContext().getProperty(ServerConstants.HTTP_SERVLET_REQUEST);
      return request.getRemoteAddr();
   }

}
```

Limitations

See "Processing SOAP Headers" on page C-7.

Additional Information

For more information on:

- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".

  assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".

17

Using WebServicesAssembler

This chapter describes the functionality provided by the WebServicesAssembler tool.

About the WebServicesAssembler Tool

The WebServicesAssembler tool assists in assembling Oracle Application Server Web Services. It enables you to generate the artifacts required to develop and deploy Web services, regardless of whether you are creating the service top down or bottom up. The WebServicesAssembler can also be invoked to create Web service client objects based on a WSDL.

Support for Top Down Web Service Generation

In the top down case, you provide WebServicesAssembler with a WSDL and it creates the service endpoint interfaces. You can then fill in the implementation for the service for any required architecture, such as Java classes. For an example of top down Web service development that uses WebServicesAssembler, see Chapter 5, "Assembling a Web Service from a WSDL".

Support for Bottom Up Web Service Generation

In the bottom up case, you start with existing business logic, such as Java classes, Enterprise Java Beans (EJBs), CORBA objects, JMS queues, or database artifacts such as PL/SQL procedures. WebServicesAssembler uses these artifacts to assemble a WSDL, a mapping file, and the necessary deployment descriptors. For examples of bottom up Web service assembly that use WebServicesAssembler, see the following chapters.

- Chapter 6, "Assembling a Web Service with Java Classes"
- Chapter 7, "Assembling a Web Service with EJBs"
- Chapter 8, "Assembling Web Services with JMS Destinations"
- Chapter 9, "Developing Database Web Services"

Support for XML Schema-Driven Web Service Generation

In the schema-driven case, you start with an XML schema and generate Java beans. Once you have the Java beans, you write the interface that uses the beans as arguments and use the bottom up paradigm to generate the WSDL, mapping file and deployment descriptors.

While you could use JAX-B or Toplink to generate beans from XML schemas, you could also use WebServicesAssembler or Ant tasks. For more information on using WebServicesAssembler or Ant tasks to generate a Web service from a schema, see "Using Custom Serialization in Schema-Driven Web Service Development" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Support for Deployment

Although the OC4J container handles deployment, the WebServicesAssembler tool assists you by ensuring that the application archives it generates are properly prepared for deployment. WebServicesAssembler handles the generation of all relevant deployment descriptors and maps proprietary configuration needed by the applications into Oracle-specific deployment files. Applications based on Java classes or EJB 2.1 are deployable across different containers. These Web services are in a J2EE standard deployable form and adhere to industry standards, such as the JAX-RPC, Enterprise Web Services 1.1, and Web Services-Interoperability (WS-I) specifications.

Support for Command Line Invocation and Ant Tasks

The WebServicesAssembler tool can be invoked either on the command line or by Ant tasks. WebServicesAssembler allows you flexibility in how you assemble your Web service. You can break the assembly process into a number of steps that let you more closely control how the Web service is created. For example, you can perform the following tasks.

- Use another mechanism to create deployment descriptors

  To do this, WebServicesAssembler provides command line arguments to add and delete services from deployment descriptors. This means that you can start with a set of hand-coded deployment descriptors that contain information that WebServicesAssembler does not generate. You can then use WebServicesAssembler to append information to these descriptors.
- Control when artifacts are compiled and which classpath to use
- Control when artifacts are packaged into an archive
- Control the content of the archive
- Create platform-independent build files

Command Line Syntax

The WebServicesAssembler tool supports a number of commands. When you invoke WebServicesAssembler, only one command can appear on the command line.

A typical command line has the following syntax.

```
java -jar [OC4J_HOME]/webservices/lib/wsa.jar -[command] -[argument name][argument value]...
```

In this example, *OC4J_HOME* is where OC4J was installed and `wsa.jar` is the name of the WebServicesAssembler JAR file. Note the following command line syntax rules.

- A command must be specified first on the command line.

- Commands and arguments must be preceded with a dash "-".
- A space must separate an argument name from its value.
- All argument names are case-sensitive.
- If a white space is required in an argument value, the value must be escaped.

  For example, on Windows and Linux, white space must be double-quoted. Other operating systems may require a different way to pass white space as parameters to a Java executable.
- All arguments that are used after the command can be placed in any order.
- Typically, an argument can appear only once on the command line. Exceptions to this rule are noted in the individual argument descriptions.

Setting Up Ant for WebServicesAssembler

To call WebServicesAssembler commands from Ant tasks, you may need to make some changes and additions to your installation of Ant. These changes and additions are described in "Setting Up Ant for WebServicesAssembler" on page 3-3.

WebServicesAssembler Commands

This section describes the commands available for the WebServicesAssembler tool. The commands are organized into the following categories based on the functionality they provide.

- Web Service Assembly Commands—assemble Web services. These commands create all of the files necessary to create a deployable archive such as a WAR, an EAR, or an EJB JAR.
- WSDL Management Commands—perform actions on a WSDL, such as generate a WSDL for bottom up development, manage its contents and location, and determine whether it can be processed by WebServicesAssembler.
- Java Generation Commands—generate code to create a Java interface from a WSDL, a proxy/stub, or JAX-RPC value type classes.
- Deployment Descriptor Generation Commands—generate deployment descriptors for EARs, WARs, or EJB JARs.
- Maintenance Commands—return a short description of WebServicesAssembler commands and the version number of the tool.

Web Service Assembly Commands

The following commands can be used to assemble a Web service.

- aqAssemble—Assembles a Web service from a Advanced Queue in the database
- assemble—Assembles a deployable archive for a Web service
- corbaAssemble—Assembles a Web service endpoint from a CORBA servant object
- dbJavaAssemble—Assembles Web services from a Java class in a database
- ejbAssemble—Assembles an EJB as a Web service
- jmsAssemble—Assembles a JMS Endpoint Web service
- plsqlAssemble—Assembles a Web service from a PL/SQL package

- sqlAssembles—Assembles a Web service from SQL query or DML statements
- topDownAssemble—Assembles Web service classes and deployment descriptors from a WSDL specification

These commands share the following functionality and behavior:

- Each of the `*Assemble` commands creates all of the files required for a deployable archive.
- Each of the `*Assemble` commands, except `topDownAssemble`, calls the `assemble` command after they generate a Java class.
- The files created by the `*Assemble` commands are placed in the staging directory structure under the directory specified by the `output` argument. Figure 17–1 illustrates the staging directory structure created by the `*Assemble` commands.
- The names and contents of the `ear` and `war` directories are affected by the values you provide for the `ear` and `war` arguments. For more information, see the arguments "ear" on page 17-38 and "war" on page 17-45.
- The output of each of the `*Assemble` commands, except `ejbAssemble`, is an EAR and a WAR file, and an optional directory that contains the contents of a WAR that can be deployed into an OC4J instance.
- The contents of the classpath are not copied to the archive. If you specify the `classpath` or `input` arguments to any of the `*Assemble` commands, you must be sure that the classes found in the classpath are also available in the server.
- You can add files to an EAR or WAR file before it is archived by the `*Assemble` commands. For more information, see "Adding Files to an Archive" on page 17-74.

Figure 17–1 illustrates the staging directory structure created by the `*Assemble` commands. Beneath the specified output directory, the commands create three subdirectories: `ear`, `src`, and `war`.

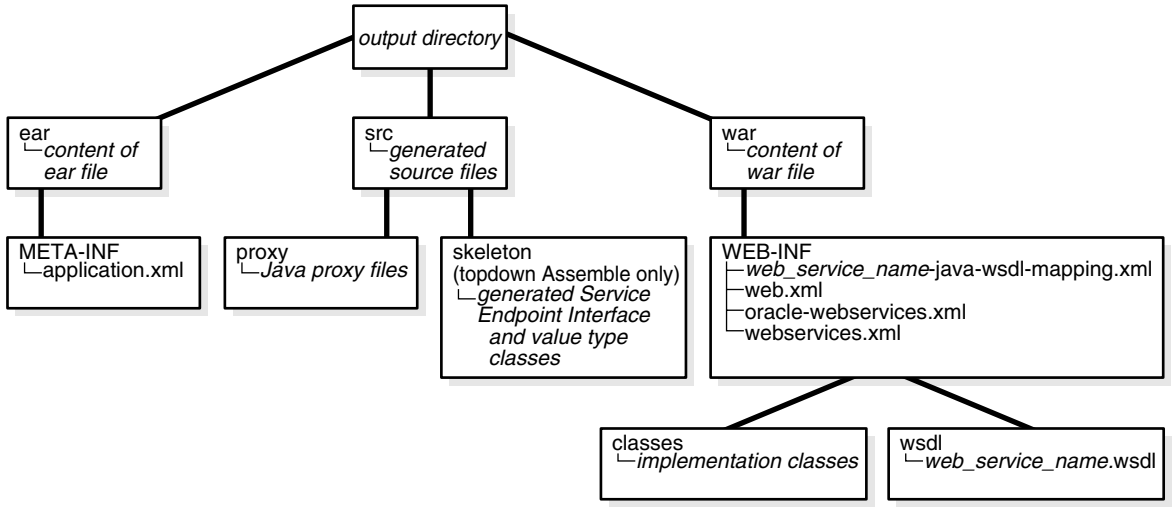
- The `ear` subdirectory contains the contents of the generated EAR file. It also contains a `META-INF` subdirectory that contains the `application.xml` file.
- The `src` subdirectory contains the generated source files. It also contains a `proxy` subdirectory that contains the Java proxy files. If the Web Service is assembled from a WSDL (top down), `src` also contains subdirectory with a skeleton of the generated service endpoint interface and value type classes.
- The `war` subdirectory contains the contents of the generated WAR file. This subdirectory also contains a `WEB-INF` subdirectory. `WEB-INF` contains the mapping files and the standard and Oracle-proprietary deployment descriptors. These files include the *web-service_name*`_java_wsdl_mapping.xml`, `web.xml`, `oracle-webservices.xml` and `webservices.xml` files.

  `WEB-INF` also contains the `classes` and `wsdl` subdirectories. The `classes` subdirectory contains the implementation classes. The `wsdl` subdirectory contains the Web service's WSDL file.

Note: WebServicesAssembler does not remove files from the `war` and `ear` staging directories by default. If you use the same output directory for multiple invocations of WebServicesAssembler, then you may find extra, unwanted files in the WAR and EAR archives. If you want to avoid this behavior, do one of the following:

- specify a different output directory for each invocation of WebServicesAssembler
- delete the contents of the output directory in between calls to the WebServicesAssembler invocations

Figure 17–1 Staging Directory Structure Created by the *Assemble Commands



aqAssemble

Use the `aqAssemble` command to generate Web services from an advanced queue in the database. To use this command, you must connect to a database. "Establishing a Database Connection" on page 17-66 describes the arguments that allow you to do this.

The `aqAssemble` command can also add WSIF bindings for an advanced queue to the WSDL. Use the `wsifDbBinding` argument to add WSIF bindings to the WSDL when you are exposing a database resource as a Web service. You must specify the `className` of the resource's Oracle JPublisher-generated Java class and a database connection. "Configuring a WSIF Endpoint for Database Resources" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on adding bindings for database resources to the WSDL.

"Exposing an Oracle Streams AQ as a Web Service" on page 9-20 provides more information about using the `aqAssemble` command to expose an advanced queue as a Web service.

Command Line Example:

```
java -jar wsa.jar -aqAssemble
                  -dbUser scott/tiger
                  -sql ToyQueue
                  -dbConnection jdbc:oracle:thin:@dsunrde22:1521:sqlj
                  -dataSource jdbc/OracleManagedDS
                  -appName query
```

Ant Task Example:

```
<oracle:aqAssemble
     dbUser="scott/tiger"
     sql="ToyQueue"
     dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
     dataSource="jdbc/OracleManagedDS"
     appName="query"
/>
```

Required Arguments:

To use the `aqAssemble` command, you must specify the following arguments.

- **Database Assembly Arguments:** sql

  You must also connect to the database. To do this, use one of the following combinations of arguments.

  - dataSource, dbConnection, and dbUser
  - dataSource

All Arguments:

The following list identifies all of the arguments that can be used with the `aqAssemble` command.

- **Database Assembly Arguments:** aqConnectionFactoryLocation, aqConnectionLocation, dataSource, dbConnection, dbUser, jpubProp, sql (required), sqlTimeout, sysUser, useDataSource, wsifDbBinding, wsifDbPort

  For more information on these arguments, see "Database Assembly Arguments" on page 17-47.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, debug, ear, emptySoapAction, help, interfaceName, mappingFileName, output, packageName, portName, restSupport, schema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **Java Generation Arguments:** valueTypeClassName

  For more information on this argument, see "Java Generation Arguments" on page 17-60.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **Session Arguments:** timeout

  For more information on this argument, see "Session Arguments" on page 17-45.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `aqAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

assemble

Use the `assemble` command to generate a Web service bottom up. The command creates all of the files required to create a deployable archive. These files include the proprietary `oracle-webservices.xml` deployment descriptor.

To find the Java implementation class, you must specify an `input` or `classpath` argument. If you specify either of these arguments, you must be sure that the classes found in the classpath are also available in the server. This is because the contents of the classpath are not copied to the archive.

In addition to generating a Web service, the `assemble` command can also add WSIF bindings to the WSDL. Use the `wsifJavaBinding` argument to add WSIF bindings to the WSDL when you are exposing a Java class as a Web service. You must also specify the Java class with the `className` argument. For more information, see "Configuring a WSIF Endpoint for Multiple Java Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*. For more information on WSIF, see "Using Web Services Invocation Framework" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Assembling a Web Service with J2SE 5.0 Annotations

If you are using the `assemble` command to assemble a Web service from Java classes that contain J2SE 5.0 Annotations, then use the `className` argument to identify the implementation class. The `@WebService` annotation must be present on the class declaration.

J2SE 5.0 annotations require a class name because annotations can appear in either the interface or the implementation class. If the annotations appear only in the interface, WebServicesAssembler can obtain them through its referenced implementation class. If the implementation class also contains annotations, WebServicesAssembler will process them.

The following example illustrates the `assemble` command being used to generate a Web service from a Java class that contains J2SE 5.0 annotations. The `className` argument specifies the `com.mycompany.HelloImpl` class.

```
java -jar wsa.jar assemble -appName myService -className com.mycompany.HelloImpl
-output wsdl
```

If you want WebServicesAssembler to process only the annotations in the interface, then enter the `@WebService` annotation with the `serviceEndpointInterface`

property in the implementation class file. J2SE 5.0 annotations will expect all remaining annotations to appear in the service endpoint interface class. For example, if you enter the following annotation in the implementation class file, then WebServicesAssembler will process only the annotations in the `demo.myInterface` interface.

```
@WebService(serviceEndpointInterface="demo.myInterface")
```

The following command line and Ant task examples demonstrate how to use the `assemble` command to generate a Web service bottom up. The command will create an EAR file named `build/myService.ear`.

Command Line Example:

```
java -jar wsa.jar -assemble
                  -input myservice.jar
                  -className com.mycompany.HelloImpl
                  -interfaceName com.myCompany.myService.Hello
                  -output build
                  -appName myService
```

Ant Task Example:

```
<oracle:assemble appName="myService"
          output="build"
          input="myservice.jar
          >
          <oracle:porttype
            interfaceName="com.myCompany.myService.Hello"
            className="com.mycompany.HelloImpl"/>
</oracle:assemble>
```

Required Arguments:

To use the `assemble` command, you must specify the following arguments.

- **General Assembly Arguments:** className

All Arguments

The following list identifies all of the arguments that can be used with the `assemble` command.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, bindingName, className (required), classpath, debug, ear, emptySoapAction, help, input, interfaceFileName, interfaceName, mappingFileName, output, portName, portTypeName, restSupport, schema, serviceName, strictJaxrpcValidation, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** valueTypeClassName, wsifJavaBinding

  For more information on these arguments, see "Java Generation Arguments" on page 17-60.

- **JMS Assembly Arguments:** sendConnectionFactoryLocation, sendQueueLocation

For more information on these argument, see "JMS Assembly Arguments" on page 17-51.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **Session Arguments:** callScope, recoverable, session, timeout

  For more information on these arguments, see "Session Arguments" on page 17-45.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Supports:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `assemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<porttype>` tags. For more information, see "Configuring a Port Type in an Ant Task" on page 17-70.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.
- tags to specify WSIF bindings for multiple ports. For more information, see "Configuring a WSIF Endpoint for Multiple Java Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

corbaAssemble

Use the `corbaAssemble` command to expose a CORBA servant object as a Web service. The command takes a CORBA IDL file and CORBA naming properties as input. It outputs all of the files required to create a deployable archive.

Internally, WebServicesAssembler will invoke the IDL-to-Java compiler (`idlj`) that can be found in the environment. The JDK `bin` directory must be part of the `path` environment variable. WebServicesAssembler uses the IDL-to-Java compiler to compile the IDL file into Java classes.

Command Line Example

```
java -jar wsa.jar -corbaAssemble
                  -idlInterfaceName oraclecorba.Hello
                  -corbanameURL corbaname::corba.orbd.host:1050#oracle.corba/Hello
                  -idlFile ./Hello.idl
                  -uri /corba_hello
                  -output dist
                  -context corba_hello
                  -targetNamespace http://oracle.j2ee.ws/corba/Hello
```

```
                -typeNamespace http://oracle.j2ee.ws/corba/Hello/types
                -serviceName Corba_hello
                -appName corba_hello
                -style rpc
                -use literal
```

Ant Task Example:

```
<oracle:corbaAssemble idlInterfaceName="oraclecorba.Hello"
               corbanameURL="corbaname::corba.orbd.host:1050#oracle.corba/Hello"
               idlFile="./Hello.idl"
               output="dist"
               context="corba_hello"
               targetNamespace="http://oracle.j2ee.ws/corba/Hello"
               typeNamespace="http://oracle.j2ee.ws/corba/Hello/types"
               serviceName="Corba_hello"
               appName="corba_hello"
               style="rpc"
               use="literal"
               >
               <oracle:port  uri="/corba_hello" />
    </oracle:corbaAssemble>
```

Required Arguments:

To use the `corbaAssemble` command, you must specify the following arguments.

- **CORBA Assembly Arguments:** idlInterfaceName

All Arguments:

The following list identifies all of the arguments that can be used with the `corbaAssemble` command.

- **CORBA Assembly Arguments:** corbanameURL, corbaObjectPath, idlFile, idlInterfaceName (required), idljPath, ORBInitialHost, ORBInitialPort, ORBInitRef

  For more information on these arguments, see "CORBA Assembly Arguments" on page 17-46.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, bindingName, className, classpath, debug, ear, emptySoapAction, help, mappingFileName, output, packageName, portName, portTypeName, restSupport, schema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **JMS Assembly Arguments:** sendConnectionFactoryLocation, sendQueueLocation

  For more information on these arguments, see "JMS Assembly Arguments" on page 17-51.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **Message Format Arguments:** style, use

For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `corbaAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

dbJavaAssemble

Use the `dbJavaAssemble` command to generate Web services from a Java class inside the Java VM in an Oracle database. To use this command, you must connect to a database. "Establishing a Database Connection" on page 17-66 describes the arguments that allow you to connect to a database.

The `dbJavaAssemble` command can also add WSIF bindings for a Java class inside the Java VM to the WSDL. Use the `wsifDbBinding` argument to add WSIF bindings to the WSDL when you are exposing a database resource as a Web service. You must specify the `className` of the resource's Oracle JPublisher-generated Java class and a database connection. "Configuring a WSIF Endpoint for Database Resources" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on adding bindings for database resources to the WSDL.

"Exposing a Server-Side Java Class as a Web Service" on page 9-28 provides more information on using the `dbJavaAssemble` command to generate Web services from a Java class inside the Java VM in an Oracle database.

Command Line Example:

```
java -jar wsa.jar -dbJavaAssemble
                  -dbJavaClassName oracle.sqlj.checker.JdbcVersion
                  -dbUser scott/tiger
                  -dbConnection jdbc:oracle:thin:@dsunrde22:1521:sqlj
                  -dataSource jdbc/OracleManagedDS
                  -appName javacallin
```

Ant Task Example:

```
<oracle:dbJavaAssemble
     dbUser="scott/tiger"
     dbJavaClassName="oracle.sqlj.checker.JdbcVersion"
     dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
     dataSource="jdbc/OracleManagedDS"
     appName="javacallin"
/>
```

Required Arguments:

To use the `dbJavaAssemble` command, you must specify the following arguments.

- **Database Assembly Arguments:** dbJavaClassName, dbUser

  You must also connect to the database. To do this, use one of the following combinations of arguments:

  - dataSource, dbConnection, and dbUser
  - dataSource

All Arguments:

The following list identifies all of the arguments that can be used with the `dbJavaAssemble` command.

- **Database Assembly Arguments:** dataSource, dbConnection, dbJavaClassName (required), dbUser, jpubProp, sysUser, useDataSource, wsifDbBinding, wsifDbPort

  For more information on these arguments, see "Database Assembly Arguments" on page 17-47.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, className, classpath, debug, ear, emptySoapAction, help, interfaceName, mappingFileName, output, packageName, portName, restSupport, schema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** valueTypeClassName

  For more information on this argument, see "Java Generation Arguments" on page 17-60.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **Session Arguments:** timeout

  For more information on this argument, see "Session Arguments" on page 17-45.

- WSDL Access Arguments: httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `dbJavaAssemble` can use these arguments: bindingName, portName (or `name`), sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

ejbAssemble

Use the `ejbAssemble` command to create an EAR or EJB JAR that can expose an EJB as a Web service. You must specify a valid version 2.1 EJB JAR as input; the system will create a WSDL and the proprietary `oracle-webservices.xml` deployment descriptor.

By default, this command creates an EAR file that contains a version 2.1 EJB file that can be deployed directly. The `oracle-webservices.xml` file specifies the context and URL pattern that can be used to access the EJB as a Web service.

If you do not want to deploy the EJB as an EAR file, you can create an EJB JAR file instead. For example, this enables you to deploy the EJB as a JAR file to a J2EE container, or to use other J2EE application deployment tools, such as Ant. To save the EJB as a JAR file, specify a directory for the `ear` argument. See "ear" on page 17-38 for a description of the different ways in which you can specify this parameter.

The `ejbAssemble` command can also add WSIF bindings to the WSDL. Use the `wsifEjbBinding` argument to add WSIF bindings when you are exposing an EJB as a Web service. You must specify the EJB's home interface in the `className` argument and its JNDI name in the `jndiName` argument. "Using Web Services Invocation Framework" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on WSIF. "Configuring a WSIF Endpoint for EJBs" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides information on adding WSIF bindings for individual and for multiple ports.

Chapter 7, "Assembling a Web Service with EJBs" provides more information on using the `ejbAssemble` command to expose a version 2.1 EJB as a Web service.

The following command line and Ant task examples create the EAR file `build/myService.ear`.

Command Line Example:

```
java -jar wsa.jar -ejbAssemble
                  -output build
                  -input myEjb.jar
                  -ejbName myEjb
                  -appName myService
```

Ant Task Example:

```
<oracle:ejbAssemble output="build"
             input="myEjb.jar"
             ejbName="myEjb"
             appName="myService"
             />
```

Required Arguments:

To use the `ejbAssemble` command, you must specify the following arguments.

- **General Assembly Arguments:** ejbName, input

All Arguments:

The following list identifies all of the arguments that can be used with the `ejbAssemble` command.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, bindingName, className, classpath, debug, ear, ejbName (required), emptySoapAction, help, initialContextFactory, input (required), interfaceName, jndiName, jndiProviderURL, mappingFileName, output, portName, portTypeName, restSupport, schema, serviceName, strictJaxrpcValidation, useDimeEncoding

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** valueTypeClassName, wsifEjbBinding

  For more information on these arguments, see "Java Generation Arguments" on page 17-60.

- **JMS Assembly Arguments:** sendConnectionFactoryLocation, sendQueueLocation

  For more information on these arguments, see "JMS Assembly Arguments" on page 17-51.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `ejbAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

- tags to specify WSIF bindings for multiple ports. For more information, see "Configuring a WSIF Endpoint for Multiple EJB Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

jmsAssemble

Use the `jmsAssemble` command to expose a JMS destination (queue or topic) as a Web service. JMS Web services have two types of operations: send and receive. The send operation sends a message to the JMS destination. The receive operation retrieves a message from the destination. Some of the JMS message properties (for example, correlation ID) can be exposed as SOAP headers.

Chapter 8, "Assembling Web Services with JMS Destinations" provides more information on using the `jmsAssemble` command to expose a JMS destination as a Web service.

Command Line Example:

```
java -jar wsa.jar -jmsAssemble
           -sendConnectionFactoryLocation jms/ws/mdb/theQueueConnectionFactory
           -sendQueueLocation jms/ws/mdb/theQueue
           -replyToConnectionFactoryLocation jms/ws/mdb/logQueueConnectionFactory
           -replyToQueueLocation jms/ws/mdb/logQueue
           -linkReceiveWithReplyTo true
           -targetNamespace http://oracle.j2ee.ws/jms-doc
           -typeNamespace http://oracle.j2ee.ws/jms-doc/types
           -serviceName JmsService
           -appName jms_service
           -context jms_service
           -input ./demo/build/mdb_service.jar
           -uri JmsService
           -output ./demo/dist
```

Ant Task Example:

```
<oracle:jmsAssemble
       linkReceiveWithReplyTo="true"
       targetNamespace="http://oracle.j2ee.ws/jms-doc"
       typeNamespace="http://oracle.j2ee.ws/jms-doc/types"
       serviceName="JmsService"
       appName="jms_service"
       context="jms_service"
       input="./demo/build/mdb_service.jar"
       output="./demo/dist"
       >
       <oracle:port  uri="JmsService"
          sendConnectionFactoryLocation="jms/ws/mdb/theQueueConnectionFactory"
          sendQueueLocation="jms/ws/mdb/theQueue"
          replyToConnectionFactoryLocation="jms/ws/mdb/logQueueConnectionFactory"
          replyToQueueLocation="jms/ws/mdb/logQueue"/>
</oracle:jmsAssemble>
```

Required Arguments:

To use the `jmsAssemble` command, you must specify the following arguments.

- **JMS Assembly Arguments:** either replyToConnectionFactoryLocation or sendConnectionFactoryLocation

All Arguments:

The following list identifies all of the arguments that can be used with the `jmsAssemble` command.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, bindingName, debug, ear, emptySoapAction, help, input, output, portName, portTypeName, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **JMS Assembly Arguments:** deliveryMode, genJmsPropertyHeader, jmsTypeHeader, linkReceiveWithReplyTo, payloadBindingClassName, priority, receiveConnectionFactoryLocation, receiveQueueLocation, receiveTimeout, receiveTopicLocation, replyToConnectionFactoryLocation, replyToQueueLocation, replyToTopicLocation, sendConnectionFactoryLocation, sendQueueLocation, sendTopicLocation, timeToLive, topicDurableSubscriptionName

  For more information on these arguments, see "JMS Assembly Arguments" on page 17-51.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Supports:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `jmsAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

plsqlAssemble

Use the `plsqlAssemble` command to generate Web services from a PL/SQL stored procedure. To use this command, you must connect to a database. "Establishing a Database Connection" on page 17-66 describes the arguments that allow you to do this.

The `plsqlAssemble` command can also add WSIF bindings for a PL/SQL stored procedure to the WSDL. Use the `wsifDbBinding` argument to add WSIF bindings to the WSDL when you are exposing a database resource as a Web service. You must specify the `className` of the resource's Oracle JPublisher-generated Java class and a database connection. "Configuring a WSIF Endpoint for Database Resources" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on adding bindings for database resources to the WSDL.

"Exposing PL/SQL Packages as Web Services" on page 9-8 provides more information on using the `plsqlAsemble` command to expose PL/SQL packages as Web services.

Command Line Example:

```
java -jar wsa.jar -plsqlAssemble
                  -appName query
                  -dbUser scott/tiger
                  -sql Company
                  -dbConnection jdbc:oracle:thin:@dsunrde22:1521:sqlj
                  -dataSource jdbc/OracleManagedDS
```

Ant Task Example:

```
<oracle:plsqlAssemble
     dbUser="scott/tiger"
     appName="query"
     sql="Company"
     dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
     dataSource="jdbc/OracleManagedDS"
/>
```

Required Arguments:

To use the `plsqlAssemble` command, you must specify the following arguments.

- **Database Assembly Arguments:** sql

  You must also connect to the database. To do this, use one of the following combinations of arguments.

  - dataSource, dbConnection, and dbUser
  - dataSource

All Arguments:

The following list identifies all of the arguments that can be used with the `plsqlAssemble` command.

- **Database Assembly Arguments:** dataSource, dbConnection, dbUser, jpubProp, sql, sysUser, useDataSource, wsifDbBinding, wsifDbPort

  For more information on these arguments, see "Database Assembly Arguments" on page 17-47.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, className, classpath, debug, ear, emptySoapAction, help, interfaceName, mappingFileName, output, packageName, portName, restSupport, schema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **Java Generation Arguments:** valueTypeClassName

  For more information on this argument, see "Java Generation Arguments" on page 17-60.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **Session Arguments:** timeout

  For more information on this argument, see "Session Arguments" on page 17-45.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `plsqlAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

sqlAssemble

Use the `sqlAssemble` command to generate Web services from SQL statements, including SQL queries and DMLs (Data Manipulation Language). To use this command, you must connect to a database. "Establishing a Database Connection" on page 17-66 describes the arguments that allow you to do this.

"Exposing a SQL Query or DML Statement as a Web Service" on page 9-14 provides a full example of generating Web services from SQL statements.

The `sqlAssemble` command can also add WSIF bindings for SQL queries to the WSDL. Use the `wsifDbBinding` argument to add WSIF bindings to the WSDL when you are exposing a database resource as a Web service. You must specify the `className` of the resource's Oracle JPublisher-generated Java class and a database connection. "Configuring a WSIF Endpoint for Database Resources" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on adding bindings for database resources to the WSDL.

The following command line and Ant task examples establish a database connection and run two SQL commands.

Command Line Example:

```
java -jar wsa.jar -sqlAssemble
  -dbUser scott/tiger
  -sqlstatement "getEmp=select ename, sal from emp where empno=:{id NUMBER}"
  -sqlstatement "getEmpBySal=select ename, sal from emp where sal>:{mysal NUMBER}"
  -dbConnection jdbc:oracle:thin:@dsunrde22:1521:sqlj
  -dataSource jdbc/OracleManagedDS
```

Ant Task Example:

```
<oracle:sqlAssemble
   dbUser="scott/tiger"
   dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
```

```
   dataSource="jdbc/OracleManagedDS"
   appName="query">
       <sqlstatement value="getEmp=select ename, sal from emp where empno=:{id
NUMBER}"/>
       <sqlstatement value="getEmpBySal=select ename, sal from emp where
sal>:{mysal NUMBER}"/>
</oracle:sqlAssemble>
```

Required Arguments:

To use the `sqlAssemble` command, you must specify the following arguments.

- **Database Assembly Arguments:** sqlstatement

  You must also connect to the database. To do this, use one of the following combinations of arguments.

  - dataSource, dbConnection, and dbUser
  - dataSource

All Arguments:

The following list identifies all of the arguments that can be used with the `sqlAssemble` command.

- **Database Assembly Arguments:** dataSource, dbConnection, dbUser, jpubProp, sql, sqlstatement, sysUser, useDataSource, wsifDbBinding, wsifDbPort

  For more information on these arguments, see "Database Assembly Arguments" on page 17-47.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, className, classpath, debug, ear, emptySoapAction, help, interfaceName, mappingFileName, output, packageName, portName, restSupport, schema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **Java Generation Arguments:** valueTypeClassName

  For more information on this argument, see "Java Generation Arguments" on page 17-60.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **Session Arguments:** timeout

  For more information on this argument, see "Session Arguments" on page 17-45.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Ant Task Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `sqlAssemble` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

topDownAssemble

Use the `topDownAssemble` command to create the required classes and deployment descriptors for a Web service based on a WSDL description. The files can be stored in either an EAR file, a WAR file, or a directory. You must specify a value for either the `input` or `classpath` arguments to allow for the proper loading of the specified implementation class.

This command is typically used with `genInterface` to generate a Web service top down. If these commands are used together to generate a Web service, then they must share the same value for the `unwrapParameters` argument.

If the WSDL contains references to multiple port types, then the `topDownAssemble` command must specify a `<porttype>` tag for each port type.

In top down Web service development, you cannot use WebServicesAssembler to change the message format. You can do this only by editing the WSDL.

Chapter 5, "Assembling a Web Service from a WSDL" provides more information on using the `topDownAssemble` command to generate a Web service based on a WSDL description.

The following command line and Ant task create required classes and deployment descriptors for a Web service. It creates an EAR `build/myService.ear`. The target of the `input` argument should contain the implementation classes. These classes will be copied to the generated archive for you.

Command Line Example:

```
java -jar wsa.jar -topDownAssemble
                  -output build
                  -wsdl my.wsdl
                  -input myClasses
                  -className com.mycompany.HelloImpl
                  -appName myService
```

Ant Task Example:

```
<oracle:topDownAssemble output="build"
                  wsdl="my.wsdl"
                  input="myClasses"
                  appName="myService">
         <porttype
           className="com.mycompany.HelloImpl"/>
         </oracle:topDownAssemble>
```

Required Arguments:

To use the `topDownAssemble` command, you must specify the following arguments.

- **General Assembly Arguments:** className; (input and/or classpath)
- **WSDL Management Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `topDownAssemble` command.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** appName, classFileName, className (required), classpath, debug, ear, emptySoapAction, help, input, interfaceName, mappingFileName, output, packageName, portName, restSupport, searchSchema, serviceName, useDimeEncoding, war

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** dataBinding, mapHeadersToParameters, overwriteBeans, unwrapParameters, valueTypePackagePrefix

  For more information on these arguments, see "Java Generation Arguments" on page 17-60.

- **WSDL Access Arguments:** fetchWsdlImports, httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on this argument, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

- `<proxy>` tags. For more information, see "Configuring Proxy Generation in an Ant Task" on page 17-67.
- `<port>` tags. In the `<port>` tag, `topDownAssemble` can use these arguments: `name` (same as `portName`), portName, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<porttype>` tags. For more information, see "Configuring a Port Type in an Ant Task" on page 17-70.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

WSDL Management Commands

The following commands perform actions on a WSDL. The `fetchWsdl` and `genQosWsdl` commands are used in top down Web service development to manage the contents and location of the WSDL. The `genWsdl` command is used to generate a WSDL for bottom up Web service development. The `analyze` command can be used

at any time to determine whether WebServicesAssembler supports the functionality described in the WSDL.

- analyze—Determines whether WebServicesAssembler supports the functionality described in the WSDL
- fetchWsdl—Copies the WSDL and its imports to an output directory
- genConcreteWsdl—Creates a concrete WSDL by determining the message format from the abstract part of the WSDL
- genQosWsdl—Inserts assertions about Quality of Service (capability assertions) into the WSDL
- genWsdl—Generates a WSDL based on a Java interface

analyze

Use the `analyze` command to confirm whether the WSDL can be processed by this version of the WebServicesAssembler. The `analyze` command determines whether the specified WSDL can be used to generate a proxy or create an interface for top down assembly. The command also checks that the WSDL uses valid XML and whether it complies with the JAX-RPC requirements of OC4J.

This command returns a message if the WSDL cannot be processed.

> **Note:** The `analyze` command does not check conformance to the Web Services Interoperability (WS-I) specification or general interoperability of your WSDL. You may want to use the WS-I Analyzer tool either directly, or from inside JDeveloper to check conformance. For more information on tools that you can use to check interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

The following command line and Ant task examples demonstrate using `analyze` to see if the specified WSDL can be processed.

Command Line Example:

```
java -jar wsa.jar -analyze
                  -wsdl myservice.wsdl
```

Ant Task Example:

```
<oracle:analyze wsdl="myservice.wsdl"
         />
```

Required Arguments:

To use the `analyze` command, you must specify the following argument.

- **WSDL Access Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `analyze` command.

- **General Assembly Arguments:** debug, help

For more information on these arguments, see "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on this argument, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

None

fetchWsdl

Use the `fetchWsdl` command in top down Web service generation to copy the base (or top level) WSDL file and all of its imported and included WSDLs and schemas into a specified output directory.

All of the WSDLs and schemas are downloaded into the same directory. Any naming conflicts are resolved by appending a number to the name of the file before the extension. For example, if three `myschema.xsd` files are downloaded, they will be named `myschema.xsd`, `myschema1.xsd`, and `myschema2.xsd`.

The following command line and Ant task examples will fetch the base WSDL specified by the URL, and any other WSDL fragments and schemas it imports. The results are then stored in the `wsdl` directory.

Command Line Example:

```
java -jar wsa.jar -fetchWdsl
                  -wsdl http://someserver/services/aservice?WSDL
                  -output wsdl
```

Ant Task Example:

```
<oracle:fetchWsdl wsdl="http://someserver/services/aservice?WSDL"
          output="wsdl"
          />
```

Required Arguments:

To use the `fetchWsdl` command, you must specify the following argument.

- **WSDL Access Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `fetchWsdl` command.

- **General Assembly Arguments:** debug, help, output

  For more information on these arguments, see "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

None

genConcreteWsdl

While an abstract WSDL is enough to define the API for a Web service, WebServicesAssembler needs a concrete WSDL to deploy a Web service or to generate client proxies that can communicate with a Web service.

If you have only an abstract WSDL, use the `genConcreteWsdl` command. In top down Web service development, this command enables you to generate a concrete WSDL given an abstract WSDL. The command does this by analyzing the `wsdl:portType` part of the WSDL and determining whether the bindings for the Web service (that is, the `use` and `style` values) should be document/literal or RPC/literal. The command writes these values into the `binding` element of the WSDL, and saves it with the name determined by the value of the `output` argument.

The following command line and Ant task examples take an abstract WSDL `myAbstract.wsdl` as input and generate a concrete WSDL `myConcrete.wsdl` in the `outputDir` directory.

Command Line Example:

```
java -jar wsa.jar -genConcreteWsdl
                  -output outputDir/myConcrete.wsdl
                  -wsdl myAbstract.wsdl
```

Ant Task Example:

```
<oracle:genConcreteWsdl output="outputDir/myConcrete.wsdl"
                 wsdl="myAbstract.wsdl" />
```

Required Arguments:

To use the `genConcreteWsdl` command, you must specify the following argument.

- **WSDL Access Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `genConcreteWsdl` command.

- **Deployment Descriptor Arguments:** ddFileName

  For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** debug, help, output

  For more information on these arguments, see "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, importAbstractWsdl, wsdl (required)

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** singleService, wsdlTimeout

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

None.

genQosWsdl

In top down Web service development, use the `genQosWsdl` command to add capability assertions for security and reliability into a specified WSDL. Capability assertions are descriptions of Web service management policies that allow consumers of Web services to discover which management policies are enabled for the Web service. "Working with Capability Assertions" in the *Oracle Application Server Advanced Web Services Developer's Guide* describes how capability assertions are derived and how they are inserted into the WSDL.

Usually, the capability assertions are defined in the deployment descriptor. Use the `ddFileName` argument to specify the file that contains the capability assertions and the `wsdl` argument to specify the name of the WSDL into which they will be inserted. The `output` argument specifies where the modified WSDL file will be stored. If you do not specify the `output` argument, then the original WSDL will be overwritten.

The following command line and Ant task examples add assertions to `my.wsdl` and store the results in the `build` directory.

Command Line Example:

```
java -jar wsa.jar -genQosWsdl
                  -wsdl my.wsdl
                  -ddFileName oracle-webservices.xml
                  -output build
```

Ant Task Example:

```
<oracle:genQosWsdl wsdl="my.wsdl"
            ddFileName="oracle-webservices.xml"
            output="build"
            />
```

Required Arguments:

To use the `genQosWsdl` command, you must specify the following arguments.

- **Deployment Descriptor Arguments:** ddFileName
- **WSDL Management Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `genQosWsdl` command.

- **Deployment Descriptor Arguments:** ddFileName (required)

For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** debug, help, output

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

None

genWsdl

Use the `genWsdl` command to generate a WSDL and a JAX-RPC mapping file for assembling Web services bottom up from a Java interface. This command requires either an `interfaceName` argument or a `className` argument that points to an annotated Java class to provide the WSDL with a value for the service endpoint interface.

The following example illustrates the `genWsdl` command. The `interfaceName` argument specifies the `oracle.j2ee.demo.HelloIntf` interface.

```
java -jar wsa.jar genWSDL -interfaceName oracle.j2ee.demo.HelloIntf -output wsdl
-classpath classes
```

Generating WSDLs with WSIF Bindings

The `genWsdl` command can use the following arguments to add WSIF bindings to the generated WSDL.

- the `wsifJavaBinding` argument adds WSIF bindings to the WSDL when you are exposing a Java class as a Web service. You must also specify the Java class with the `className` argument.
- the `wsifEjbBinding` argument adds WSIF bindings to the WSDL when you are exposing an EJB as a Web service. You must specify the EJB's home interface in the `className` argument and its JNDI name in the `jndiName` argument.
- the `wsifDbBinding` argument adds WSIF bindings to the WSDL when you are exposing a database resource as a Web service. You must specify the `className` of the resource's Oracle JPublisher-generated Java class and a database connection.

You can also use the `genWsdl` command to add WSIF bindings for multiple ports in the WSDL. For more information, see "Using Web Services Invocation Framework" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Generating WSDLs for use with J2SE 5.0 Annotations

If you are generating a WSDL from J2SE 5.0 Annotations, then use the `className` argument instead of the `interfaceName` argument. The `className` argument must

identify the implementation class and the `@WebService` annotation must be present on the class declaration.

Use the `interfaceName` argument if the specified `className` does not contain any J2SE 5.0 Annotations.

J2SE 5.0 Annotations require a class name because annotations can appear in either the interface or the implementation class. If the annotations appear only in the interface, WebServicesAssembler can obtain them through its referenced implementation class. If the implementation class also contains annotations, WebServicesAssembler will process them.

In the following example, the `genWsdl` command is used to generate a WSDL for use with J2SE 5.0 annotations. The `className` argument specifies the `oracle.j2ee.demo.HelloImpl` class.

```
java -jar wsa.jar genWsdl -className oracle.j2ee.demo.HelloImpl -output wsdl
-classpath classes
```

If you want WebServicesAssembler to process only the J2SE 5.0 annotations in the interface, then enter the `@WebService` annotation with the `serviceEndpointInterface` property in the implementation class file. J2SE 5.0 Annotations will expect all remaining annotations to appear in the service endpoint interface class. For example, if you enter the following annotation in the implementation class file, then WebServicesAssembler will process only the annotations in the `demo.myInterface` interface.

```
@WebService(serviceEndpointInterface="demo.myInterface")
```

The following command line and Ant task output a JAX-RPC mapping file and a WSDL that corresponds to the Java interface specified by `interfaceName`. The results are stored in the `etc` directory.

Command Line Example:

```
java -jar wsa.jar -genWsdl
                  -classpath myservice.jar
                  -output etc
                  -interfaceName com.mycompany.myservice.Hello
```

Ant Task Example:

```
<oracle:genWsdl output="etc"
    >
    <oracle:porttype interfaceName="com.mycompany.myservice.Hello"/>
    <oracle:classpath>
        <pathelement path="myservice.jar" />
    </oracle:classpath>
</oracle:genWsdl>
```

Required Arguments:

To use the `genWsdl` command, you must specify the following arguments.

- **General Assembly Arguments:** classpath; when generating a WSDL using J2SE 5.0 Annotations, `genWsdl` requires either interfaceName or a className that points to an annotated Java class

All Arguments:

The following list identifies all of the arguments that can be used with the `genWsdl` command.

- **Database Assembly Arguments:** dataSource, dbConnection, dbUser, wsifDbBinding, wsifDbPort

  For more information on these arguments, see "Database Assembly Arguments" on page 17-47.

- **Deployment Descriptor Arguments:** ddFileName

  For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** bindingName, className (required for J2SE 5.0 Annotations), classpath (required), debug, emptySoapAction, help, initialContextFactory, interfaceName (required for J2SE 5.0 Annotations), jndiName, jndiProviderURL, mappingFileName, output, portName, portTypeName, schema, serviceName, strictJaxrpcValidation

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** valueTypeClassName, wsifEjbBinding, wsifJavaBinding

  For more information on these arguments, see "Java Generation Arguments" on page 17-60.

- **JMS Arguments:** sendConnectionFactoryLocation, sendQueueLocation

  For more information on these arguments, see "JMS Assembly Arguments" on page 17-51.

- **Message Format Arguments:** style, use

  For more information on these arguments, see "Message Format Arguments" on page 17-60.

- **WSDL Management Arguments:** createOneWayOperations, genQos, soapVersion, targetNamespace, typeNamespace

  For more information on these arguments, see "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

- `<port>` tags. In the `<port>` tag, `genWsdl` can use these arguments: bindingName, `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, soapVersion, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<porttype>` tags. For more information, see "Configuring a Port Type in an Ant Task" on page 17-70.
- tags to specify WSIF bindings for multiple ports. For more information, see "Configuring a WSIF Endpoint for Multiple Java Ports", "Configuring a WSIF Endpoint for Multiple EJB Ports", and "Configuring a WSIF Endpoint for Multiple Database Resource Ports", in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Java Generation Commands

The following commands generate code to create a Java interface, a proxy/stub, or JAX-RPC value type classes.

- genInterface—Generates a Java interface from a WSDL file

- genProxy—Generates a proxy/stub from a WSDL file
- genValueTypes—Generates JAX-RPC value type classes from an XML schema

genInterface

For top down Web service development, this command creates a service endpoint interface for each port type and a Java value type class (beans) for any complex type defined in a WSDL. It also creates a JAX-RPC mapping file that describes the mapping between the XML schema types and the Java value type classes. These files can then be used to construct a J2EE Web service client or to create an implementation that can run on the server. See Chapter 13, "Assembling a J2EE Web Service Client" for more information on how to use `genInterface` to construct a J2EE Web service client. See Chapter 5, "Assembling a Web Service from a WSDL" for more information on how to use `genInterface` to create a server-side implementation.

For more information on how WebServicesAssembler performs package-to-namespace mappings, see "Default Algorithms to Map Between Target WSDL Namespaces and Java Package Names" on page 17-63. For information on how WebServicesAssembler maps special characters in the WSDL, such as periods (`.`) and dashes (`-`) see the JAX-RPC 1.1 specification.

`http://java.sun.com/webservices/jaxrpc/index.jsp`

The following command line and Ant task examples create a service endpoint interface in the `src` directory (`src/oracle/demo/service`).

Command Line Example:

```
java -jar wsa.jar -genInterface
                  -output src
                  -wsdl myservice.wsdl
                  -packageName oracle.demo.service
```

Ant Task Example:

```
<oracle:genInterface output="src"
              wsdl="myservice.wsdl"
              packageName="oracle.demo.service"
              />
```

Required Arguments:

To use the `genInterface` command, you must specify the following argument.

- **WSDL Access Arguments:** wsdl

All Arguments

The following list identifies all of the arguments that can be used with the `genInterface` command.

- **Deployment Descriptor Arguments:** ddFileName

  For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** classpath, debug, help, mappingFileName, packageName, output, searchSchema, serviceName

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** dataBinding, mapHeadersToParameters, overwriteBeans, unwrapParameters, valueTypePackagePrefix

  For more information on these arguments see, "Java Generation Arguments" on page 17-60.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on these arguments see, "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument see, "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

None

genProxy

Use the `genProxy` command to create a static proxy stub that can be used by a J2SE Web service client. This command creates all of the Java files required to contact the ports specified in the WSDL. To use the proxy, you must first compile the code. For more information on using `genProxy` to create proxy stub code, see Chapter 14, "Assembling a J2SE Web Service Client".

The following command line and Ant task examples create all of the proxy code and store it in the `proxysrc` directory.

Command Line Example:

```
java -jar wsa.jar -genProxy
                  -output proxysrc
                  -wsdl myservice.wsdl
```

Ant Task Example:

```
<oracle:genProxy output="proxysrc"
          wsdl="myservice.wsdl"
          />
```

Required Arguments:

To use the `genProxy` command, you must specify the following argument.

- **WSDL Access Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `genProxy` command.

- **Deployment Descriptor Arguments:** ddFileName

  For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** classpath, debug, help, mappingFileName, packageName, output, searchSchema, serviceName, useDimeEncoding

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **Java Generation Arguments:** dataBinding, mapHeadersToParameters, overwriteBeans, unwrapParameters, valueTypePackagePrefix

  For more information on these arguments see, "Java Generation Arguments" on page 17-60.

- **JMS Assembly Arguments:** replyToConnectionFactoryLocation, replyToQueueLocation

  For more information on these arguments see, "JMS Assembly Arguments" on page 17-51.

- **Proxy Arguments:** endpointAddress, genJUnitTest

  For more information on these arguments see, "Proxy Arguments" on page 17-55.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on these arguments, see "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument see, "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

- `<handler>` tags—For more information, see "Configuring Handlers in an Ant Task" on page 17-71.
- `<port>` tags—In the `<port>` tag, `genProxy` can use these arguments: endpointAddress, `name` (same as `portName`), portName, replyToConnectionFactoryLocation, and replyToQueueLocation. For more information, see "Configuring a Port in an Ant Task" on page 17-69.

genValueTypes

Use the `genValueTypes` command to create JAX-RPC value type classes (beans) from the specified schemas. This command creates the beans for schema-driven Web service development.

WebServicesAssembler can create more than one value type class for each `genValueTypes` invocation. The command supports more than one `schema` argument on the command line or `<schema value="">` line in an Ant task.

In addition to the beans, this command creates the `custom-type-mappings.xml` and `jaxrpc-mappings.xml` files. The `custom-type-mappings.xml` file makes it easier to configure the custom serializer. The generated custom type mapping file conforms to the service side schema, but it can be modified slightly to be used on the client side. For an example of an edited service side custom type mapping file, see "Editing the Server Side Custom Type Mapping File" in the *Oracle Application Server Advanced Web Services Developer's Guide*. For more information on the custom serializer, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

The `jaxrpc-mappings.xml` file is a partial JAX-RPC mapping file that can be supplied when generating the WSDL for bottom up Web service development.

The following command line and Ant task examples create a value type (bean) for every complex type defined in the schemas `mySchema.xsd` and `otherSchema.xsd`

and creates the files `custom-type-mappings.xml` and `jaxrpc-mappings.xml`. The beans and files are stored in the `build` directory.

Command Line Example:

```
java -jar wsa.jar -genValueTypes
                  -schema mySchema.xsd
                  -schema otherSchema.xsd
                  -packageName com.mycompany
                  -output build
```

Ant Task Example:

```
<oracle:genValueTypes packageName="com.mycompany" output="build">
                 <oracle:schema value="otherSchema.xsd"/>
                 <oracle:schema value="mySchema.xsd"/>
 </oracle:genValueTypes>
```

Required Arguments:

To use the `genValueTypes` command, you must specify the following argument.

- **General Assembly Arguments:** schema

All Arguments:

The following list identifies all of the arguments that can be used with the `genValueTypes` command.

- **General Assembly Arguments:** debug, help, packageName, output, schema (required)

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort

  For more information on these arguments see, "WSDL Access Arguments" on page 17-57.

Additional Ant Support:

None

Deployment Descriptor Generation Commands

The following commands create deployment descriptors or files that are used in generating descriptors for the EAR.

- genApplicationDescriptor—Creates an `application.xml` file
- genDDs—Creates deployment descriptors

genApplicationDescriptor

Use the `genApplicationDescriptor` command to create an `application.xml` file that can be used when generating an EAR.

The `input` argument must be a directory that contains the WARs and EJB JARs that will be placed in the EAR. The generated `application.xml` will contain tags for each of the WARs and EJB JARs found in the specified `input` directory.

Command Line Example:

```
java -jar wsa.jar -genApplicationDescriptor
                  -input src/ejb
                  -output build
```

Ant Task Example:

```
<oracle:genApplicationDescriptor
        input="src/ejb"
        output="build"
/>
```

Required Arguments:

To use the `genApplicationDescriptor` command, you must specify the following argument.

- **General Assembly Arguments:** input

All Arguments:

The following list identifies all of the arguments that can be used with the `genApplicationDescriptor` command.

- **Deployment Descriptor Arguments:** context

  For more information on this argument, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** debug, help, input (required), output

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

Additional Ant Support:

None

genDDs

Use the `genDDs` command in top down or bottom up Web service generation to create the `web.xml`, `webservices.xml`, and `oracle-webservices.xml` deployment descriptors.

The following command line and Ant task examples create the deployment descriptors and store them in the `WEB-INF` directory.

Command Line Example:

```
java -jar wsa.jar -genDDs
                  -output WEB-INF
                  -wsdl myservice.wsdl
                  -classpath myservice.jar
                  -interfaceName com.mycompany.myservice.Hello
                  -className com.mycompany.myservice.HelloImpl
```

Ant Task Example:

```
<oracle:genDDs output="WEB-INF"
        wsdl="myservice.wsdl"
        classpath="myservice.jar"
        >
        <oracle:porttype
           interfaceName="com.mycompany.myservice.Hello"
```

```
      className="com.mycompany.myservice.HelloImpl"/>
</oracle:genDDs>
```

Required Arguments

To use the `genDDs` command, you must specify the following arguments.

- **General Assembly Arguments:** className, interfaceName
- **WSDL Access Arguments:** wsdl

All Arguments:

The following list identifies all of the arguments that can be used with the `genDDs` command.

- **Deployment Descriptor Arguments:** appendToExistingDDs, context, ddFileName, uri

  For more information on these arguments, see "Deployment Descriptor Arguments" on page 17-55.

- **General Assembly Arguments:** className (required), classpath, debug, ejbName, help, interfaceName (required), mappingFileName, output, serviceName, strictJaxrpcValidation, useDimeEncoding

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

- **JMS Assembly Arguments:** sendConnectionFactoryLocation, sendQueueLocation

  For more information on these arguments see, "JMS Assembly Arguments" on page 17-51.

- **WSDL Access Arguments:** httpNonProxyHosts, httpProxyHost, httpProxyPort, wsdl (required)

  For more information on these arguments see, "WSDL Access Arguments" on page 17-57.

- **WSDL Management Arguments:** wsdlTimeout

  For more information on this argument see, "WSDL Management Arguments" on page 17-58.

Additional Ant Support:

- `<port>` tags. In the `<port>` tag, `genDDs` can use these arguments: `name` (same as `portName`), portName, sendConnectionFactoryLocation, sendQueueLocation, and uri. For more information, see "Configuring a Port in an Ant Task" on page 17-69.
- `<porttype>` tags. For more information, see "Configuring a Port Type in an Ant Task" on page 17-70.
- `<handler>` tags. For more information, see "Configuring Handlers in an Ant Task" on page 17-71.

Maintenance Commands

The following commands return a short description of WebServicesAssembler commands and the version number of the tool.

- help—Returns a list of WebServicesAssembler commands

- version—Returns the version of the WebServicesAssembler tool

help

Use the `help` command to return a list of WebServicesAssembler commands and a brief description. WebServicesAssembler will also return help when it is run:

- without any commands or arguments. For example,

  ```
  java -jar wsa.jar
  ```

- with incorrect commands or arguments. For example,

  ```
  java -jar wsa.jar -myProxy -ootput proxysrc -wsdl myservice.wsdl
  ```

You can get help on a specific command by running WebServicesAssembler with the command followed by `-help`. For example, the following command returns detailed help on the `genProxy` command and its required and optional arguments.

```
java -jar wsa.jar -genProxy -help
```

The `help` command is supported only on the command line. There is no comparable Ant task. The following command line example returns help text on the commands and arguments supported by WebServicesAssembler.

Command Line Example:

```
java -jar wsa.jar -help
```

Ant Task Example:

No Ant support provided.

Required Arguments:

None

All Arguments:

The following argument can be used with the `help` command:

- **General Assembly Arguments:** debug

  For more information on this argument see, "General Web Services Assembly Arguments" on page 17-36.

Additional Ant Support:

None

version

Use the `version` command to obtain the version number of the WebServicesAssembler tool.

Command Line Example:

```
java -jar wsa.jar -version
```

Ant Task Example:

No Ant support provided.

Required Arguments:

None

All Arguments:

- **General Assembly Arguments:** debug, help

  For more information on these arguments see, "General Web Services Assembly Arguments" on page 17-36.

Additional Ant Support:

None

WebServicesAssembler Arguments

This section describes the arguments that can be called for WebServicesAssembler commands.

- General Web Services Assembly Arguments
- Session Arguments
- CORBA Assembly Arguments
- Database Assembly Arguments
- JMS Assembly Arguments
- Proxy Arguments
- Deployment Descriptor Arguments
- WSDL Management Arguments
- Message Format Arguments
- Java Generation Arguments

General Web Services Assembly Arguments

This section describes common arguments that can be used by many of the WebServicesAssembler commands. They include file-related input and output arguments, WSDL-related arguments, and mapping-related arguments.

- appName
- bindingName
- classFileName
- className
- classpath
- debug
- ear
- ejbName
- emptySoapAction
- help
- initialContextFactory
- input

appName

`appName <String>`
Specifies the name of an application. Usually, this name is used as a base value for other arguments like `context` and `uri`. The value of this argument is also used to name the EAR and the WAR files if the `ear` and `war` arguments are not specified.

bindingName

`bindingName <String>`
The name of the binding to use in the generated WSDL.

classFileName

`classFileName <String>`
Identifies the Java file name of the implementation class specified in the `className` argument. If necessary, this file will be compiled during an assembly.

className

`className <String>`
Specifies the name of the class (including the package name) that is the implementation class for the Web service.

Using this argument adds the `<servlet-class>` element to `web.xml`.

If you are exposing an EJB as a Web service, the value of the `className` argument must be the EJB's home interface. For more information, see "ejbAssemble" on page 17-13.

If this argument is used with the `wsifJavaPort` argument, a `classname` attribute is added to the `java:address` element in the `port` component of the WSDL.

If this argument is used with the `wsifEjbPort` argument, a `classname` attribute is added to the `ejb:address` element in the `port` component of the WSDL.

classpath

`classpath <String>`
Specifies the classpath that contains any user-created classes given to WebServicesAssembler. One reason to specify this argument is if you have already created some value type classes or exceptions and you do not want WebServicesAssembler to overwrite them.

For commands that generate a WAR file, such as the `*Assemble` commands, this argument enables you to point to classes the Web service has a dependency on and that should not be placed in the generated WAR.

This argument does not cause any additional classes to be copied to a generated WAR file. Any classes needed at runtime or deployment time must either be copied to the WAR or EAR manually or made available on the application server classpath using server configuration options.

To include classes in the WAR file, you also have the option of using the `input` argument. For more information, see "input" on page 17-40.

If you list multiple paths on the classpath, separate them with a colon (:) if you are using the UNIX operating system. If you are using the Windows operating system, separate multiple paths with a semicolon (;).

debug

`debug <true|false>`
Indicates whether all detailed diagnostic messages should be printed for a given command. Default value is `false`.

The following command line and Ant task examples will display diagnostic messages on the performance of the `assemble` command.

Command Line Example:

```
java -jar -wsa.jar -assemble -debug true...
```

Ant Task Example:

```
<oracle:assemble debug="true"
    ....
 />
```

ear

`ear <file name>`
Specifies the name and location of the generated EAR. The following example creates the EAR file `myService.ear` in the `dist` directory.

```
-ear dist/myService.ear
```

The following list describes how WebServicesAssembler interprets the value of the `ear` argument.

- If the value of the `ear` argument ends with a file name with the extension "`.ear`" (as in the preceding example), then an EAR file with the specified name is created at the location specified by the `ear` argument. The `output` argument is not used to determine the location of the EAR file.
- In all other cases, the name is assumed to be a directory name. An EAR file is not created. Instead, the contents of the EAR will be written to the indicated directory.
- If you specify a value for the `output` argument and do not provide the `ear` argument, then the EAR file will be given the value of the `appName` argument as

its default name. For example, if the value of `output` is `build` and the value of `appName` is `myService`, and `ear` is not specified, then the EAR file will be created as `build/myService.ear`.

Note: If you specify the same directory for the `ear` and the `output` argument, then WebServicesAssembler will return an error.

The `ear` and `war` arguments can be used together in the same command line or Ant task. Table 17–1 describes the behavior of these arguments based on whether they specify a file or a directory.

Table 17–1 Behavior of ear and war Arguments for File and Directory Values

ear and war Argument Combination	Behavior
`ear` *directory1* `war` *directory2*	If the `ear` and `war` arguments are set to different directories, the following behavior will occur: ■ no `.ear` file will be created ■ the contents of the `.ear` file will be generated into *directory1* ■ a `.war` file will be created in *directory1* ■ the contents of the `.war` file will be generated into *directory2*
`ear` *directory1* `war` *file*	If the `ear` argument is set to a directory and the `war` argument is set to a file, the following behavior will occur: ■ no `.ear` file will be created ■ the contents of the `.ear` file will be generated into *directory1* ■ a `.war` file will be created in *directory1* ■ a `.war` file will be created with the user-specified name (the value of the *file* parameter)
`ear` *file* `war` *directory2*	If the `ear` argument is set to a file and the `war` argument is set to a directory, the following behavior will occur: ■ a `.ear` file will be created with the user-specified name (value of the *file* parameter) ■ a `.war` file will be created in the `.ear` file ■ the contents of the `.war` will be generated into *directory2*
`ear` *file1* `war` *file2*	If the `ear` argument is set to a file and the `war` argument is set to a file, the following behavior will occur: ■ a `.ear` file will be created with the user-specified name (value of the *file1* parameter) ■ a `.war` file will be created in the `.ear` file ■ a `.war` file will be created with the user-specified name (the value of the *file2* parameter)
`ear` argument not specified `war` argument not specified	If neither the `ear` nor the `war` argument are specified, the following behavior will occur: ■ a `.ear` file will be generated with the default name *application_name*`.ear` ■ a `.war` file will be generated with the default name *application_name*`_web.war` In these examples, *application_name* represents the value of the `appName` argument.

ejbName

`ejbName <String>`
The name of the EJB to be exposed as a Web service. Note that this is not a class name; it is the unique name of the EJB that is specified in the `<ejb-name>` tag in the `ejb-jar.xml` file.

If the EJB is version 2.1, using this argument adds the `<ejb-link>` element to `webservices.xml`.

emptySoapAction

`emptySoapAction <true|false>`
If `true`, the value of the `soapAction` attribute for each SOAP binding operation in the generated WSDL will be set to an empty string. If `false` (default), the target namespace and the operation name (*<target-namespace>*/*<operation-name>*) is used as the value of the `soapAction` attribute.

Tools from other vendors that use OracleAS Web Services WSDLs to generate the client-side proxy may not be able to recognize or honor the default `soapAction` value. Setting this argument to `true` increases the chances of interoperability with these tools.

help

`help`
Displays a help message for a given command. The `help` argument can either precede or follow the command.

The following command line and Ant task examples will display a help message on the `assemble` command.

Command Line Example:

```
java -jar -wsa.jar -assemble -help ...
```

or

```
java -jar -wsa.jar -help -assemble ...
```

Ant Task Example:

```
<oracle:assemble debug="help"
    ....
 />
```

initialContextFactory

`initialContextFactory <String>`
Specifies the name of the factory that will provide the initial context. This is an optional argument that can be called by the `genWsdl` or `ejbAssemble` command when configuring an EJB WSIF port with `wsifEjbBinding` or `wsifEjbPort`. If you not provide a value for this attribute, the value in the `jndi.properties` file will be used.

input

`input <String>`
Specifies the directory or JAR containing the classes that should be copied to `WEB-INF/classes`. This argument will be added to the classpath used by the WebServicesAssembler. The `ejbAssemble` command assumes the value of the input is an EJB JAR file or a directory that contains the contents of an EJB JAR.

If this argument specifies a JAR, then it will be expanded and its contents copied to the `WEB-INF/classes` directory.

This argument can be used only once in a command line or Ant task. If the specified file name cannot be found, WebServicesAssembler will stop processing.

The `input` argument can be used more than once on the command line or in an Ant task. In an Ant task, write the multiple occurrences in separate tags and include the `value` attribute. Example 17–1 illustrates multiple instances of `input` in an Ant task.

Example 17–1 Multiple Instances of input in an Ant Task

```
<oracle:jmsAssemble
       linkReceiveWithReplyTo="true"
       targetNamespace="http://oracle.j2ee.ws/jms-doc"
       typeNamespace="http://oracle.j2ee.ws/jms-doc/types"
       serviceName="JmsService"
       appName="jms_service"
       context="jms_service"
       input="./demo/build/mdb_service.jar"
       output="./demo/dist"
       input="first.jar"
       >
             <oracle:input value="second.jar"/>
             <oracle:input value="third.jar"/>
</oracle:jmsAssemble>
```

interfaceFileName

`interfaceFileName <String>`
Specifies the path and name of the service endpoint interface (SEI) Java source code file. If the specified file name cannot be found, WebServicesAssembler will stop processing.

The presence of the `interfaceFileName` argument can play a role in how WebServicesAssembler represents the parameter names of Java methods in the generated WSDL. "Representing Java Method Parameter Names in the WSDL" on page 17-77 provides more information on this topic.

interfaceName

`interfaceName <String>`
Specifies the path and name of a Java class (including the package name) that contains the service endpoint interface (SEI).

Using this argument adds a `<service-endpoint-interface>`*String*`</service-endpoint-interface>` element to `WEB-INF/webservices.xml`, where *String* is the value provided for `interfaceName`.

Using this argument with any of the commands which assemble a Web service from database resources (`plsqlAssemble`, `sqlAssemble`, `dbJavaAssemble`, or `aqAssemble`), adds the `<service-endpoint-interface>`*String*`</service-endpoint-interface>` element to `query-java-wsdl-maping.xml`, where *String* is the value provided for `interfaceName`.

jndiName

`jndiName <String>`
Specifies a JNDI name for an EJB.

jndiProviderURL

`jndiProviderURL <String>`
Specifies the URL for the JNDI Provider. This is an optional argument that can be called by the `genWsdl` or `ejbAssemble` command when configuring an EJB WSIF port with `wsifEjbBinding` or `wsifEjbPort`. If you do not provide a value for this attribute, the value in the `jndi.properties` file will be used.

mappingFileName

`mappingFileName <String>`
Specifies a file location that points to a JAX-RPC mapping file. If the specified file name cannot be found, WebServicesAssembler will stop processing.

For more information on the contents of the JAX-RPC mapping file and how it is used, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

Using this argument adds the `<jaxrpc-mapping-file>` element to `webservices.xml`. Note that the location and name of the file may be changed when it is written to the deployment descriptor. The contents of the file may be modified before being placed in the archive if some mappings were not defined in the original file.

output

`output <String>`
Specifies the directory where generated files will be stored. If the directory does not exist, it will be created. If you do not specify the `output` argument, then the output will be stored in the current directory.

Except when used with the `genConcreteWsdl` command, the target of the `output` argument is always assumed to be a directory. In the case of the `genConcreteWsdl` command, the target is assumed to be a file.

The `output` argument is typically used with the `ear` and `war` arguments. For more information on the behavior of `output` when it is used with these arguments, see the descriptions of "ear" on page 17-38 and "war" on page 17-45.

Note: If you specify the same directory for the `output` and the `ear` (or `war`) argument, then WebServicesAssembler will return an error.

---

packageName

`packageName <String>`
Specifies the package name that will be used for generated classes if no package name is declared in the JAX-RPC mapping file. If `packageName` is not specified and not declared in the mapping file, then the package name will be derived from the target namespace of the WSDL.

For more information on namespace to package mappings see "Default Algorithms to Map Between Target WSDL Namespaces and Java Package Names" on page 17-63.

Note: The `packageName` argument affects only the package name for the service endpoint interface and any schema types that have the same target namespace as the WSDL. If there are schema value types in a different namespace, then WebServicesAssembler generates them into a different package by default. For information on generating the code into a single package, see "Generating Code into a Single Package from a WSDL with Multiple Namespaces" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

portName

`portName <String>`
Specifies the name of a port in a WSDL document. This argument populates the `<port name="...">` WSDL element.

If a port name is not specified, then the default will be based on either the transport and SOAP version, or on the WSIF type. The default port name will be one of the following values.

- `HttpSoap11`
- `HttpSoap12`
- `JmsSoap11`
- `JmsSoap12`
- `WsifEjb`
- `WsifJava`

portTypeName

`portTypeName <String>`
Specifies the name of the port type to use in the generated WSDL. This argument populates the `<portType name="...">` WSDL element.

restSupport

`restSupport <true|false>`
Specifies whether REST (Representational State Transfer) support will be enabled for this Web service. The default value is `false`.

REST services allow you to get and modify service objects with the HTTP GET and POST commands. Another feature of REST Web services is the use of XML documents, not SOAP envelopes, for sending messages. See Chapter 11, "Assembling REST Web Services" for more information on implementing Web services with REST support.

schema

`schema <String>`
Specifies the relative path or URL to an XML schema document. This argument enables you to specify a schema for value types instead of letting WebServicesAssembler generate them. This argument must be used in conjunction with a JAX-RPC mapping file. For information on specifying a mapping file, see "mappingFileName" on page 17-42.

The `schema` argument can be used more than once on the command line or in an Ant task. In an Ant task, write the multiple occurrences in separate tags and include the `value` attribute. Example 17–2 illustrates multiple instances of `schema` in an Ant task.

Example 17–2 Multiple Instances of schema in an Ant Task

```
<oracle:genValueTypes packageName="com.mycompany"
              output="build">
                   <oracle:schema value="otherSchema.xsd"/>
                   <oracle:schema value="mySchema.xsd"/>
 </oracle:genValueTypes>
```

searchSchema

`searchSchema <true|false>`

Indicates whether all of the types in the schemas listed in the WSDL should be processed. When this argument is set to `true` (default), all of the types will be processed. This is useful when using a Web service implementation that uses types found in the schemas, but are not directly referenced by the WSDL. When this argument is set to `false`, the types that are not referenced by the WSDL will not be processed.

serviceName

`serviceName <`*`String`*`>`

Specifies the service name. The `serviceName` argument is used to identify the generated or packaged WSDL file (*serviceName*`.wsdl`) and the mapping file (*serviceName*`-java-wsdl-mapping.xml`). In bottom up Web service assembly, this argument also provides a value for the `<service name="...">` WSDL element.

When this argument is used in top down Web service and proxy assembly, the WSDL will expect to find a service with this name. In this case, the value of the `<service name="...">` WSDL element will not be changed.

strictJaxrpcValidation

`strictJaxrpcValidation <true|false>`

Determines whether the service endpoint interface, exceptions, and value types will be validated according to all of the JAX-RPC validation rules. If this argument is not specified or set to `true` (default), the following validation checks are performed:

- the service endpoint interface implements `java.rmi.Remote`
- all methods throw `java.rmi.RemoteException`
- all value types and properties in exceptions follow JAX-RPC rules

If any of these validation checks fail, then processing stops and an error is thrown describing what is wrong with the interface.

If this argument is set to `false`, then a service endpoint interface does not have to implement `java.rmi.Remote` and methods do not have to throw `java.rmi.RemoteException`. However, if any method has parameters or exceptions that do not follow JAX-RPC rules, then the method will be ignored and will not be processed.

In the case of Beans and exceptions, if this argument is set to false, any invalid property in the Bean (or exception) will be ignored. Valid properties will be processed and included in the WSDL. Note that this behavior might produce a wire-level format that the user is not expecting. For invalid properties, WebServicesAssembler will throw a warning.

useDimeEncoding

`useDimeEncoding <true|false>`

Specifies whether DIME encoding will be used for streaming SOAP messages with attachments over the wire. If `useDimeEncoding` is set to `true`, DIME encoding is used for attachments instead of MIME. The default value is `false`. "Working with DIME Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information about working with DIME encoding and attachments.

Using this argument adds the `<use-dime-encoding>` element to `oracle-webservices.xml`.

war

`war <file name or directory name>`

Specifies the name of the WAR to generate. If a file is specified, it must have the `.war` extension. If a directory is specified, the contents of the WAR will be written to the indicated directory. The following example creates the WAR file `myService.war` in the `dist` directory.

```
-war dist/myService.war
```

The following list describes how WebServicesAssembler interprets the value of the `war` argument.

- If the value of the `war` argument ends with a file name with the extension "`.war`" (see the preceding example), then a WAR file with the specified name is created at the location specified by the `war` argument. The `output` argument is not used to determine the location of the WAR file.
- In all other cases, the value is assumed to be a directory name. The WAR file will be written to the indicated directory.
- If you specify a value for the `output` argument and do not provide the `war` argument, then the WAR will be placed inside of an EAR. The name of the WAR file inside of the EAR will be *appName*`.war`. See "ear" on page 17-38 for a description of how WebServicesAssembler interprets values for the `ear` argument.

> **Note:** If you specify the same directory for the `war` and the `output` argument, then WebServicesAssembler will return an error.

The war and `ear` arguments can be used together in the same command line or Ant task. See Table 17–1 for a description of the behavior of these arguments based on whether they specify a file or a directory.

Session Arguments

These arguments can be used to control the behavior of session state.

- callScope
- recoverable
- session
- timeout

callScope

`callScope <true|false>`

Indicates that the servant is to be created for each call and is garbage-collected after each call. Default value is `false`. An error will be thrown if both `callScope` and `session` are set to `true`.

Using this argument with the value set to `true` adds the `<param name="scope">call</param>` element to `oracle-webservices.xml`.

recoverable

`recoverable <true|false>`
Indicates whether applications with session state are recoverable. This argument can be used only when the service is exposed as a stateful web services with session scope. The default, `true`, causes session state to be preserved. If it is recoverable, then a Boolean `<distributable>` element is added to `web.xml`. If it is `false`, the distributable element will not be added.

session

`session <true|false>`
Indicates that the servant instance is to be preserved for the duration of the HTTP session. This argument is valid only for HTTP transport. Session timeout can be tuned by the `timeout` argument. Default value is `false`. If `timeout` is set, then `session` is set to `true` by default. An error will be thrown if both `callScope` and `session` are set to `true`.

Using this argument adds the `<param name="scope">session</param>` element to `oracle-webservices.xml`.

timeout

`timeout <`*`int`*`>`
Specifies the number of seconds a session should last before it times out. The default value is 60 seconds. If the value is 0 or a negative number, then the session will not time out.

If a value is set for this argument, then the `session` argument is automatically set to `true`. If the `session` argument is `true` and `timeout` is not set, then the session will time out after 60 seconds.

Using this argument adds the `<param name="session-timeout">`*value*`</param>` element to `oracle-webservices.xml`, where *value* is the integer value given to `timeout`.

CORBA Assembly Arguments

The following arguments can be used by the `corbaAssemble` command. They can be used to control how a Web service is assembled using CORBA servant objects.

- corbanameURL
- corbaObjectPath
- idlFile
- idlInterfaceName
- idljPath
- ORBInitialHost
- ORBInitialPort
- ORBInitRef

corbanameURL

`corbanameURL <String>`
Specifies a URL for locating the CORBA object using a CORBA Naming Service.

corbaObjectPath

`corbaObjectPath <String>`
Specifies a path to the CORBA object.

idlFile

`idlFile <String>`
Specifies the location of the CORBA `idl` file.

idlInterfaceName

`idlInterfaceName <String>`
Specifies the name of the interface in the `idl` from which the Web service will be generated.

idljPath

`idljPath <String>`
Specifies the path to the directory containing the IDL-to-Java compiler (`idlj`) if it is not already specified in the `path`.

ORBInitialHost

`ORBInitialHost <String>`
Specifies the host name of the ORB.

ORBInitialPort

`ORBInitialPort <String>`
Specifies the port for the ORB.

ORBInitRef

`ORBInitRef <String>`
Specifies an ORB initial reference.

Database Assembly Arguments

These arguments are used by the commands that assemble a Web service from database artifacts such as PL/SQL stored procedures, SQL statements, Oracle Advanced Queues (AQ), and Java classes inside the Java VM in an Oracle database.

For more information on assembling Web services from database artifacts, see Chapter 9, "Developing Database Web Services".

- aqConnectionFactoryLocation
- aqConnectionLocation
- dataSource
- dbConnection
- dbJavaClassName
- dbUser
- jpubProp

- sql
- sqlstatement
- sqlTimeout
- sysUser
- useDataSource
- wsifDbBinding
- wsifDbPort

aqConnectionFactoryLocation

`aqConnectionFactory <String>`
Specifies the JNDI location of the Oracle Streams AQ JMS queue connection factory for the exposed AQ.

aqConnectionLocation

`aqConnectionLocation <String>`
Specifies the JDNI location of the Oracle Streams AQ JMS queue connection connecting to the exposed AQ.

dataSource

`dataSource <String>`
Specifies the JNDI location of the data source used by the Web services at runtime.

Using this argument adds the following `param` attribute to the `<implementor>` element in `oracle-webservices.xml`. The *dataSource value* variable is the path specified with the `dataSource` argument.

`<param name="databaseJndiName">`*dataSource value*`</param>`

For example, if you specify `dataSource="ws/dbws/src/query/datasource"` in an Ant task, the `<implementor>` element will be written as follows.

```
<implementor type="database">
     <param name="databaseJndiName">ws/dbws/src/query/datasource</param>
</implementor>
```

dbConnection

`dbConnection <String>`
Specifies the JDBC URL for the database. This argument is used with the `dbUser` argument to connect to a database at code-generation time.

dbJavaClassName

`dbJavaClassname <String>`
Specifies the name of the server-side Java class to be published as a Web service.

dbUser

`dbUser <String>`
Specifies the database schema and password in the form of *user/password*. This argument is used with the `dbConnection` argument to connect to a database at code-generation time.

If you attempt to access the database by invoking WebServicesAssembler on the command line and do not specify a password with `-dbUser`, you will be prompted for a password. This is to protect the password being shown in clear text.

jpubProp

`jpubProp <String>`
Specifies the name of a file with properties to control the Oracle JPublisher translation process. For examples of how you might use the `jpubProp` argument, see "Changing the SQL to XML Mapping for Numeric Types" on page 9-5. For more information on Oracle JPublisher, see the *Oracle Database JPublisher User's Guide*.

sql

`sql <String>`
The value of the `sql` argument has a different meaning depending on whether it is used with `aqAssemble` or `plsqlAssemble`.

- `aqAssemble`—When used with `aqAssemble`, the value of `sql` is an AQ queue name.
- `plsqlAssemble`—When used with `plsqlAssemble`, the value of `sql` is a PL/SQL package name.

The `sql` argument can handle case-sensitive names in SQL statements. For example, the use of quotes in the following SQL statement indicates that the package name, `SIMple`, is case sensitive.

```
create package "SIMple" as
procedure foo;
end;
```

To use the `SIMple` package name as the target of the `sql` argument on the command line, enter:

```
-sql '"SIMple"'
```

To use it in an Ant task, enter:

```
sql="&quot;SIMple&quot;"
```

Note that in each case, the quotations enclosing `SIMple` are required. The quotations and the package name are passed to Oracle JPublisher. Oracle JPublisher uses the quotations to resolve the identifier against the name in the database.

sqlstatement

`sqlstatement <String>`
Specifies the DML statement or SQL query to be published as a Web service.

- SQL statements must be either queries or DML statements.
- SQL statements are tagged with the name that will be used in the WSDL and in generated Java code.

  methodName=<statement>

  The *methodName* indicates the Java method name for the SQL statement in the generated Web services.
- SQL statements may contain embedded host variables with a parameter name and corresponding SQL type. The parameter name is used in the WSDL and in the generated Java code. The parameter is given in the following form.

:{*param_name param_sql_type*}

In this example, *param_name* defines the Java identifier for the parameter in the generated Web service, and *param_sql_type* defines the SQL type name for that parameter.

- The `sqlstatement` argument cannot be used to specify stored procedures.

When you pass a SQL statement on the WebServicesAssembler Ant task, you must ensure that it is correctly quoted. The value of `sqlstatement` can be quoted using standard XML quotations as shown in Table 17–2:

Table 17–2 Valid Quoting Symbols for the sqlstatement Ant Task

Symbol	Quotation
&	&amp;
"	&quot;
<	&lt;
>	&gt;
'	&apos;

Multiple `sqlstatement` arguments can be specified on the command line or Ant task. In an Ant task, write the multiple occurrences in separate tags and use the `value` attribute. Example 17–3 illustrates multiple instances of the `sqlstatement` argument in an Ant task.

Example 17–3 Multiple Instances of sqlstatement in an Ant Task

```
<oracle:sqlAssemble
   dbUser="scott/tiger"
   dbConnection="jdbc:oracle:thin:@dsunrde22:1521:sqlj"
   dataSource="jdbc/OracleManagedDS"
   appName="query">
       <sqlstatement value="getEmp=select ename, sal from emp where empno=:{id
NUMBER}"/>
       <sqlstatement value="getEmpBySal=select ename, sal from emp where
sal&gt;:{mysal NUMBER}"/>
</oracle:sqlAssemble>
```

sqlTimeout

`sqlTimeout <int>`

Specifies timeout, in seconds, for the database operation. Database operations can include PL/SQL stored function or procedure invocations, SQL queries, and DML statements. The default is 0, which means the service never times out.

sysUser

`sysUser <String>`

Specifies the name and password of a user with `SYS` privileges in the form of `dbSysUser/syspassword`. Using this argument allows PL/SQL and Java wrapper code to be installed automatically into the database at code-generation time.

useDataSource

`useDataSource <true|false>`

The `useDataSource` argument can be specified on the command line or in the Ant task only when the `wsifDbBinding` or `wsifDbPort` argument is also present. If

useDataSource is specified and neither of these arguments are present, then an error is thrown.

The useDataSource argument determines whether the value of the dataSource argument will be used in the WSDL port tag. If useDataSource is not specified, or specified with the value of true, then the dataSource value used in the command line or Ant task is used in the WSDL port tag. If useDataSource is specified with the value of false, then the dbConnection value used in the command line or Ant task is used in the WSDL port tag.

wsifDbBinding

wsifDbBinding <true|false>
This argument is used in bottom up Web services assembly to add WSIF SQL bindings to the WSDL. WebServicesAssembler will generate native WSIF SQL bindings in addition to SOAP bindings in the WSDL. This argument's default value is false.

For information on the segments this argument adds to the WSDL, see "WSIF SQL Extensions to the WSDL" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

If you need more control over the definition of the WSIF SQL bindings or need to specify multiple ports, OracleAS Web Services provides additional arguments that are available only by using Ant tasks. These arguments are described in "Configuring a WSIF Endpoint for Multiple Database Resource Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

wsifDbPort

wsifDbPort <true|false>
This argument is used in bottom up Web services assembly to add WSIF bindings for database resources for multiple ports to the WSDL. It can be used only in Ant tasks. "Configuring a WSIF Endpoint for Multiple Database Resource Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on how to use wisfDbPort.

JMS Assembly Arguments

The following arguments can be used by the jmsAssemble command and by JMS transport. The jmsAssemble command assembles a JMS Endpoint Web service EAR or WAR directory. For more information assembling a JMS Endpoint Web service, see Chapter 8, "Assembling Web Services with JMS Destinations".

Of the arguments listed, replyToConnectionFactoryLocation, replyToQueueLocation, sendConnectionFactoryLocation, and sendQueueLocation can be used by either JMS assembly or by JMS transport.

You can find the JMS specification at the following Web address.

http://java.sun.com/products/jms/docs.html

- deliveryMode
- genJmsPropertyHeader
- jmsTypeHeader
- linkReceiveWithReplyTo
- payloadBindingClassName
- priority

- receiveConnectionFactoryLocation
- receiveQueueLocation
- receiveTimeout
- receiveTopicLocation
- replyToConnectionFactoryLocation
- replyToQueueLocation
- replyToTopicLocation
- sendConnectionFactoryLocation
- sendQueueLocation
- sendTopicLocation
- timeToLive
- topicDurableSubscriptionName

deliveryMode

`deliveryMode <String>`
Specifies the default value of the `JMSDeliveryMode` header field. This field contains the delivery mode specified when the message was sent. The values for `deliveryMode` supported by the JMS specification are `PERSISTENT` and `NON_PERSISTENT`.

genJmsPropertyHeader

`genJmsPropertyHeader <true|false>`
By default, JMS Endpoint Web services always publish the following JMS message properties of SOAP headers defined on the generated WSDL.

- message ID
- correlation ID
- the ReplyTo destination, including its name, type, and factory

The corresponding schema definition of the JMS-specific header and its binding will be included in the WSDL. Set this argument to `false` and the `OracleJmsProperties` on the wire SOAP message will be ignored at runtime. Default value is `true`.

jmsTypeHeader

`jmsTypeHeader <String>`
The value of this argument is used to specify the default value of the `JMSType` header field for the JMS messages that are propagated by the `send` operation to a JMS destination. For example, a possible value for `jmsTypeHeader` could be `My Quote Message`. No default value is provided.

linkReceiveWithReplyTo

`linkReceiveWithReply <true|false>`
Determines whether the `receive` operation will be linked to the reply-to destination. When this argument is `true`, either receive destination/connection-factory or reply-to destination/connection-factory must be set. Default value is `false`.

payloadBindingClassName

`payloadBindingClassname <String>`
The fully-qualified Java class name of the content object of `javax.jms.ObjectMessage` instance if no data binding is used. The content is not a Java value type but an XML fragment. The only valid values are `java.lang.String` and `javax.xml.soap.SOAPElement`. Default value is `java.lang.String`.

priority

`priority <int>`
Specifies the default integer value of the JMS message priority header field for the JMS messages that are propagated by the `send` operation to a JMS destination. Values can range from 0 to 9, with 0 as lowest priority and 9 as highest.

receiveConnectionFactoryLocation

`receiveConnectionFactoryLocation <String>`
JNDI name of the JMS `ConnectionFactory` used for the `receive` operation. The type of `ConnectionFactory` must be consistent with the `receive` destination. No default value is provided.

receiveQueueLocation

`receiveQueueLocation <String>`
JNDI name of the JMS Queue used for the `receive` operation. The `receiveQueueLocation` and `receiveTopicLocation` arguments are mutually exclusive and cannot both be set. No default value is provided.

receiveTimeout

`receiveTimeout <int>`
The value of this argument is used to specify the default value for the amount of time that the `receive` method is blocked to get a message. The `receiveTimeout` value is expressed in seconds. The default value, 0, means that blocking never expires and the call blocks indefinitely.

receiveTopicLocation

`receiveTopicLocation <String>`
JNDI name of the JMS Topic used for the `receive` operation. No default value is provided. The `receiveQueueLocation` and `receiveTopicLocation` arguments are mutually exclusive and cannot both be set.

replyToConnectionFactoryLocation

`replyToConnectionFactoryLocation <String>`
Specifies the JNDI name of the JMS connection factory to be used as the default reply-to of all `send` operation JMS messages. The type of `ConnectionFactory` must be consistent with the reply-to destination. No default value is provided. This argument can be used for JMS Web service assembly or for JMS transport.

When this argument is used for JMS transport, it specifies the JNDI name of the JMS `ConnectionFactory` to be used as the default reply-to of all Web service operations that send SOAP messages over the wire.

replyToQueueLocation

`replyToQueueLocation <String>`

Specifies the JNDI name of the JMS queue to be used as the default reply-to of all `send` operation JMS messages. No default value is provided. The `replyToQueueLocation` and `replyToTopicLocation` arguments are mutually exclusive and cannot both be set. This argument can be used for JMS Web service assembly or for JMS transport.

When this argument is used for JMS transport, it specifies the JNDI name of the JMS queue to be used as the default reply-to of all Web service operations that send SOAP messages over the wire.

replyToTopicLocation

`replyToTopicLocation <String>`
Specifies the JNDI name of the JMS Topic to be used as the default reply-to of all `send` operation JMS messages. No default value is provided. The `replyToQueueLocation` and `replyToTopicLocation` arguments are mutually exclusive and cannot both be set.

sendConnectionFactoryLocation

`sendConnectionFactoryLocation <String>`
Specifies the JNDI name of the JMS `ConnectionFactory` used to obtain a connection for the JMS `send` operation. The type of `ConnectionFactory` must be consistent with the `send` destination. No default value is provided. This argument can be used for JMS Web service assembly or for JMS transport.

When this argument is used for JMS transport, it specifies the JNDI name of the JMS `ConnectionFactory` used to obtain a connection for the Web service operation that sends the SOAP messages over the wire.

sendQueueLocation

`sendQueueLocation <String>`
Specifies the JNDI name of the JMS queue to be used for the JMS `send` operation. No default value is provided. The `sendQueueLocation` and `sendTopicLocation` arguments are mutually exclusive and cannot both be set. This argument can be used for JMS Web service assembly or for JMS transport.

When this argument is used for JMS transport, it specifies the JMS queue to be used for the Web service operation that sends the SOAP messages over the wire.

sendTopicLocation

`sendTopicLocation <String>`
JNDI name of JMS Topic used for `send` operation. No default value is provided. The `sendQueueLocation` and `sendTopicLocation` arguments are mutually exclusive and cannot both be set.

timeToLive

`timeToLive <int>`
The value of this argument specifies the default time-to-live value of a JMS `send` operation. The value of `timeToLive`, expressed in seconds, is a relative value—not absolute. When a message is sent, its expiration time is calculated as the sum of the time-to-live value specified on the JMS `send` method and the current GMT value. If the argument is not set or if it is set to 0, then the message will never expire.

topicDurableSubscriptionName

`topicDurableSubscriptionName <String>`

The value of this argument is used as a unique identity to register a durable subscription for the Topic `receive` operation. No default value is provided. See the JMS specification for more information on durable subscriptions.

`http://java.sun.com/products/jms/docs.html`

Proxy Arguments

These arguments can be used to control the contents of the generated proxy code.

- endpointAddress
- genJUnitTest

endpointAddress

`endpointAddress <URL>`
Specifies the URL of the endpoint address used to contact the Web service. If you use this argument, then the endpoint address in the WSDL is ignored.

genJUnitTest

`genJUnitTest <true|false>`
If `genJUnitTest` is set to `true`, then a JUnit test will be created for each exposed method in the Web service and stored in the same directory as the service endpoint interface. The JUnit test which is created is only a template; you must provide the actual test code for the method. The default value is `false`.

Deployment Descriptor Arguments

The following arguments can be used to control how Web service deployment is performed.

- appendToExistingDDs
- context
- ddFileName
- uri

appendToExistingDDs

`appendToExistingDDs <true|false>`
Determines whether entries for a new Web service will be appended to the existing deployment descriptors or whether they will be overwritten. The deployment descriptors that can be affected by this argument are `oracle-webservices.xml`, `web.xml`, and `webservices.xml`.

If the argument is set to `true`, any deployment descriptors in the output location will be updated with the entries needed for a new service. If `false`, any existing deployment descriptors in the output location will be overwritten. Default value is `false`.

"Assigning Multiple Web Services to an EAR or WAR Archive" on page 17-75 describes how `appendToExistingDDs` is used to append a new Web service to an existing deployment descriptor.

Note: The `appendToExistingDDs` and the `ddFileName` argument can be used in the same invocation or Ant task. The `ddFileName` argument points to a file that contains management configuration. All of the management configuration found in this file that corresponds to the service that is generating deployment descriptors will be included in the generated `oracle-webservices.xml` file. When `appendToExistingDDs` is `false` (default), then any deployment descriptor file (`web.xml`, `oracle-webservices.xml`, or `webservices.xml`) in the output directory will be overwritten. When `appendToExistingDDs` is `true` then WebServicesAssembler will add the entries for the current service to the existing deployment descriptor file.

Note that WebServicesAssembler does not try to resolve conflicts. If you append the same service to a deployment descriptor file twice, then an invalid deployment descriptor may be the result.

context

`context <String>`

Specifies the root context for the web application. You cannot specify an empty string for `context`. If you do not provide a value for `context`, then its default value is determined as follows:

- If the command supports the `appName` argument, then the default value for `context` is the value of the `appName` argument. If the command does not support the `appName` argument, then the default value is the name of the first service in the WSDL.
- If the command does not use a WSDL, for example `genApplicationDescriptor`, then the default value for `context` is the name of the WAR file without the `-web.war` or `.war` extension.

For version 2.1 EJBs, the value of `context` is placed in the `<context-root>` element in the `oracle-webservices.xml` deployment descriptor file.

For Web applications, the value of `context` is placed in the `<context-root>` element in the `application.xml` deployment descriptor file.

The URL is built from the protocol, the host and the port. For example,

`http://localhost:8888/`*`host`*`/`*`port`*

The protocol, `http://localhost:8888/` is set at deployment time and is used to contact the Web service. The second part, the *host* is provided by the `context` argument. The third part, the *port*, is provided by the `uri` argument. The full URL is created by concatenating the protocol with the values of the `context` and `uri` arguments. See "uri" on page 17-57 for an example of using the `context` and `uri` arguments to form an HTTP URL.

ddFileName

`ddFileName <String>`

Specifies the `oracle-webservices.xml` deployment descriptor that contains the settings you want to assign to the Web service. If this argument is not used, then an `oracle-webservices.xml` deployment descriptor will be generated. For more information on this file, see "oracle-webservices.xml Deployment Descriptor" on page 18-12.

When this argument is used with the `*Assemble` commands, management and custom serialization information will be copied from the specified file to the `oracle-webservices.xml` file in the archive.

If the specified file name cannot be found, WebServicesAssembler will stop processing.

The `appendToExistingDDs` and the `ddFileName` arguments can be used in the same command line invocation or Ant task. See the **Note** under "appendToExistingDDs" on page 17-55 for more information on the impact of using these arguments together.

uri

`uri <String>`
Specifies the URI to use for the Web service. This is the third part of the URL used to contact the Web service. The first part is the protocol, which is set at deployment time. The second part is provided by the `context` argument. The full URL is created by concatenating the protocol, the context, and the uri arguments.

The default value for `uri` is the value of the `appName` argument. You cannot specify an empty string for `uri`.

Using this argument adds the `<url-pattern>` element to `web.xml` (for web applications) and the `<endpoint-address-uri>` element to `oracle-webservices.xml` for EJB 2.1.

WSDL Access Arguments

The following arguments can be used to access the WSDL. The `Http*` arguments help to access the WSDL if it is a URL and resides on a network that uses an HTTP proxy server.

- fetchWsdlImports
- httpNonProxyHosts
- httpProxyHost
- httpProxyPort
- importAbstractWsdl
- wsdl

fetchWsdlImports

`fetchWsdlImports <true|false>`
Indicates if you want to make a local copy of the WSDL and everything it imports. When `fetchWsdlImports` is `true`, the specified WSDL and everything it imports will be copied to the WAR. When `false`, only the specified WSDL will be copied to the WAR. Default value is `false`.

This argument is typically used when the WSDL must be packaged with the deployment. This avoids the overhead, un-reliability, security, or threat-of-change issues that may arise when calling out for each runtime invocation requires a remote schema. The only time you would package a WSDL and its schema imports with a Web service is in a top down assembly.

httpNonProxyHosts

`httpNonProxyHosts <String>`

Specifies the name of the host that should *not* use an HTTP proxy. If there are multiple hosts they should be separated by a '|', for example `localhost|127.0.0.1`. This argument can help to get the WSDL if it is a URL that resides on a network that uses an HTTP proxy server.

httpProxyHost

`httpProxyHost <String>`
Specifies the name of the HTTP proxy host. This argument can help to get the WSDL if it is a URL that resides on a network that uses an HTTP proxy server.

httpProxyPort

`httpProxyPort <int>`
Specifies the port number for the HTTP proxy. This argument can help to get the WSDL if it is a URL that resides on a network that uses an HTTP proxy server.

importAbstractWsdl

`importAbstractWsdl <true|false>`
Specifies whether the generated WSDL will import the WSDL specified with the `wsdl` argument. If `true`, the generated WSDL will import the WSDL file. If `false`, the generated WSDL elements and the elements in the original WSDL will be written to a single output file. Default value is `false`.

wsdl

`wsdl <String>`
Specifies the absolute file path, relative file path, or URL to a WSDL document. For example, `http://host:80/services/myservice?WSDL` and `myservice.wsdl` are valid values for this argument.

If the network uses an HTTP proxy server, and the WSDL is a URL, you may need to set the `httpNonProxyHosts`, `httpProxyHost` and `httpProxyPort` arguments.

WSDL Management Arguments

The following options can be used to control the contents of the generated WSDL.

- createOneWayOperations
- genQos
- singleService
- soapVersion
- wsdlTimeout
- targetNamespace
- typeNamespace

createOneWayOperations

`createOneWayOperations <true|false>`
When this argument is set to `true`, methods that return `void` will have no response message. If it is not specified or set to false, the response message will be empty. Default value is `false`.

genQos

`genQosWsdl <true|false>`
Determines whether QOS (quality of service) information will be added to the WSDL in the form of capability assertions. Capability assertions are derived from the Web service management configuration in the `oracle-webservices.xml` deployment descriptor. If you set `genQos` to `true`, then capability assertions will be generated into the WSDL. You must also set the `ddFilename` argument to an `oracle-webservices.xml` deployment descriptor that contains the Web services management configuration. The default value of this argument is `false`.

"Working with Capability Assertions" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides more information on providing capability assertions to the server- and client-side of a Web service.

singleService

`singleService <true|false>`
Determines whether a single port or multiple ports will be generated for each service defined in the WSDL. If `true`, WebServicesAssembler generates a single service with multiple ports (one for each port type). If `false`, WebServicesAssembler generates multiple services, each with a single port. Default is `false`.

soapVersion

`soapVersion <1.1|1.2|1.1,1.2>`
Specifies the SOAP version to the WSDL document. Values can be `1.1`, `1.2`, or `1.1,1.2`. Default value is `1.1`.

The "`1.1,1.2`" value means that WebServicesAssembler will create two ports with two bindings. One port and binding will support version 1.1; the other port and binding will support version 1.2. Each port must be bound to a different URL. That is, you cannot support both versions concurrently with the same URL address.

wsdlTimeout

`wsdlTimeout <int>`
Specifies the number of seconds WebServicesAssembler should wait for a response to an HTTP or HTTPS request for a remote WSDL resource. The default value is 60 seconds.

By default, WebServicesAssembler will wait as long as one minute to receive the response to a HTTP request for a WSDL definition from a host. This argument is used to override the default wait limit. A value of zero indicates that WebServicesAssembler will wait for a period of time determined by the platform.

This argument applies only to requests made through HTTP or HTTPS. It will be ignored if the request is made through another protocol.

targetNamespace

`targetNamespace <String>`
Specifies the target namespace to be used in the generated WSDL.

typeNamespace

`typeNamespace <String>`
Specifies the type namespace to be used in the schema types in the generated WSDL. The name that you specify will always be used and it will not be reversed. For more information on this argument and the default namespace-to-package name mapping

conventions, see "Default Algorithms to Map Between Target WSDL Namespaces and Java Package Names" on page 17-63.

Message Format Arguments

The following arguments can be used to control the message format used by the generated WSDL, and hence, the Web service.

- style
- use

style

`style <document-bare|document-wrapped|rpc>`
For bottom up Web service assembly, this argument specifies the `style` attribute of the message format in the generated WSDL. Possible values are `document-bare`, `document-wrapped`, and `rpc`. The default value is `document-wrapped`.

"OracleAS Web Services Message Formats" on page 4-1 provides more information on the RPC and document (wrapped and bare) message styles.

use

`use <literal|encoded>`
For bottom up Web service assembly, this argument specifies the `use` attribute of the message format in the generated WSDL. Possible values are `literal` and `encoded`. The default value is `literal`.

"OracleAS Web Services Message Formats" on page 4-1 provides more information on the literal and encoded message uses.

Java Generation Arguments

The following options can be used to control how Java files are generated.

- dataBinding
- mapHeadersToParameters
- overwriteBeans
- unwrapParameters
- valueTypeClassName
- valueTypePackagePrefix
- wsifEjbBinding
- wsifJavaBinding

dataBinding

`dataBinding <true|false>`
If `true`, WebServicesAssembler will attempt to generate Java value types that follow the JAX-RPC default type mapping rules for every element in the schema. If WebServicesAssembler encounters an unsupported type, it will use the `javax.xml.soap.SOAPElement` to represent it. If `false`, WebServicesAssembler uses a `SOAPElement` for every schema type it encounters. Default value is `true`.

Note: OracleAS Web Services does not support the combination of RPC-encoded message formats and `databinding=false`. This combination is not considered a "best practice" within the industry.

mapHeadersToParameters

`mapHeadersToParameters <true|false>`
Indicates if SOAP headers defined in the WSDL should be mapped to parameters for each of the methods in the generated Java code. Default value is `true`.

overwriteBeans

`overwriteBeans <true|false>`
Indicates if beans should be generated for schema types even if the class already exists in the classpath. Default value is `false`.

unwrapParameters

`unwrapParameters <true|false>`
This argument can be set only for document-literal operations and will be ignored for other message formats. Typically a document-literal operation has a single input schema type and a single output schema type. The schema types are sometimes called wrappers. When `unwrapParameters` is set to `false` the generated service endpoint interface will be generated with wrappers around the input parameter and the return type. For example, a method with wrapped parameters may look like this.

```
public EchoResponse echo(EchoRequest p) throws RemoteException;
```

When `unwrapParameters` is set to `true`, which is the default, the return type and response type will be unwrapped. This is usually easier to use, especially if the types are simple. For example, a method with unwrapped parameters may look like this.

```
public String echo(String string) throws RemoteException;
```

valueTypeClassName

`valueTypeClassName <`*`String`*`>`
Specifies the fully-qualified class name of the JAX-RPC value type which is used for `java.util.Collection` and `java.util.Map`. This argument enables you to generate schemas for these classes since the service endpoint interface does not refer to them directly.

"Oracle-Specific Type Support" on page 4-6 provides an example of using `valueTypeClassName` to declare non-built-in value types as items in a `Map` or `Collection`.

The `valueTypeClassName` argument can be used multiple times on the command line or in an Ant task. In an Ant task, write the multiple occurrences in separate tags and use the `name` attribute. Example 17–4 illustrates the use of multiple instances of `valueTypeClassName` to generate schemas for the `tClass1`, `tClass2`, and `tClass3` type classes.

Example 17–4 Multiple Instances of valueTypeClassName in an Ant Task

```
<oracle:assemble appName="myService"
   output="build"
   input="myservice.jar"
   style="rpc"
   use="encoded">
```

```
            <oracle:porttype
              interfaceName="com.myCompany.myService.Hello"
              className="com.mycompany.HelloImpl"/>
            <oracle:valueTypeClassName name="tClass1"/>
            <oracle:valueTypeClassName name="tClass2"/>
            <oracle:valueTypeClassName name="tClass3"/>
</oracle:assemble>
```

valueTypePackagePrefix

`valueTypePackagePrefix <String>`
Specifies the package name prefix for all value types that are to be created from a WSDL. This argument enables you to group value type package names by service.

All value type classes will start with the specified package name. By default, the package name for value types is based on the namespace of the complex type in the schema. This argument can be used to prefix the package name that is derived from the namespace.

For example, if `valueTypePackagePrefix` is set to `myapp`, and the type's target namespace is `http://ws-i.org/`, then the package name will be `myapp.org.ws-i`.

See "Specifying a Root Package Name" on page 17-66 for more information on how to use this argument.

If you need more control over the WSDL namespace to Java package mapping, then use a JAX-RPC mapping file. The `valueTypePackagePrefix` argument is ignored if there is a namespace to package mapping defined in the JAX-RPC mapping file. For more information on the mapping between WSDL namespaces and Java package names, see "Default Algorithms to Map Between Target WSDL Namespaces and Java Package Names" on page 17-63.

wsifEjbBinding

`wsifEjbBinding <true|false>`
This argument is used in bottom up Web services assembly to add WSIF EJB bindings to the WSDL. If `true`, you must also specify the EJB's home interface `className` and `jndiName`. WebServicesAssembler will generate native WSIF EJB bindings in addition to SOAP bindings in the WSDL. The default value is `false`.

For information on the segments this argument adds to the WSDL, see "WSIF EJB Extensions to the WSDL" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

If you need more control over the definition of the WSIF EJB bindings or need to specify multiple ports, OracleAS Web Services provides additional arguments that are available only by using Ant tasks. These arguments are described in "Configuring a WSIF Endpoint for Multiple EJB Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

The `wsifEjbBinding`, `wsifJavaBinding`, and `wsifDbBinding` arguments are mutually exclusive. An exception will be thrown if two or more of these arguments are used in a single command line or Ant task.

wsifJavaBinding

`wsifJavaBinding <true|false>`
This argument is used in bottom up Web services assembly to add WSIF Java bindings to the WSDL. If `true`, you must also specify the `className` of the Java

implementation class. WebServicesAssembler will generate native WSIF Java bindings in addition to SOAP bindings in the WSDL. The default value is `false`.

For information on the segments this argument adds to the WSDL, see "WSIF Java Extensions to the WSDL" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

If you need more control over the definition of the WSIF Java bindings or need to specify multiple ports, OracleAS Web Services provides additional arguments that are available only by using Ant tasks. These arguments are described in "Configuring a WSIF Endpoint for Multiple Java Ports" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

The `wsifEjbBinding`, `wsifJavaBinding`, and `wsifDbBinding` arguments are mutually exclusive. An exception will be thrown if two or more of these arguments are used in a single command line or Ant task.

Default Algorithms to Map Between Target WSDL Namespaces and Java Package Names

The following sections describe the default algorithms that WebServicesAssembler uses to map between namespaces and package names.

- Java Package Name to WSDL Namespace Mapping Algorithm
- WSDL Namespace to Java Package Name Mapping Algorithm

Java Package Name to WSDL Namespace Mapping Algorithm

The WebServicesAssembler constructs a default type namespace from the package name. If the package name starts with a standard top-level domain name or an International Organization for Standardization (ISO) country code, the WebServicesAssembler "reverses" the package name and places it into an HTTP URL. Otherwise, the package name is directly placed into an HTTP URL.

Note: The standard top level domain names are defined by the Internet Corporation For Assigned Names and Numbers (`http://www.icann.org/tlds/`). ISO Country codes are defined by the International Organization for Standardization (`http://www.iso.org/`).

For example, the package `com.oracle.mytypes` will have the type namespace `http://mytypes.oracle.com/`. The package `examples.chapter1` will have the type namespace `http://examples.chapter1/`.

The following sections describe the order in which the mapping algorithm in WebServicesAssembler attempts to map Java artifacts and types to WSDL artifacts and XML schema types.

- Mapping Java Artifacts to WSDL Artifacts
- Mapping Java Types to XML Schema Types

Mapping Java Artifacts to WSDL Artifacts

The following steps represent the order in which the WebServicesAssembler tool attempts to map Java artifacts to WSDL artifacts.

1. Use the value of the `targetNamespace` WebServicesAssembler argument to get the target namespace to be used in the generated WSDL. See "targetNamespace" on page 17-59 for more information on this argument.
2. Look up the value of the Java `<package-mapping>` element in the JAX-RPC mapping file.
3. Derive the name of the WSDL namespace from the Java package name of the service endpoint interface.

Mapping Java Types to XML Schema Types

The following steps represent the order in which the WebServicesAssembler tool attempts to map Java types to XML schema types.

1. Look up the value of the Java `<package-mapping>` element in the JAX-RPC mapping file.
2. Use the value of `typeNamespace` WebServicesAssembler argument to get the type namespace for the schema types in the generated WSDL. See "typeNamespace" on page 17-59 for more information on this argument.
3. Derive the WSDL namespace from the Java package of the value type.
4. Use the value of the `targetNamespace` attribute defined in the WSDL.

WSDL Namespace to Java Package Name Mapping Algorithm

The WSDL namespace to Java package name mapping is based on the algorithm in the Java Architecture for XML Data Binding (JAXB) specification, version 2.0 (`http://www.jcp.org/en/jsr/detail?id=222/`). The following are exceptions to the algorithm defined in the specification:

- The algorithm in the JAXB specification states that the scheme part of the URI should be removed only if it is either `http` or `urn`. The current implementation has expanded the set of schemes to remove. The set includes the following: `http`, `https`, `ftp`, `mailto`, `file`, `nntp`, `telnet`, `ldap`, `nfs`, `urn`, and `tftp`.
- The algorithm in the JAXB specification does not specify what action to take when NLS characters are present in the URI. In the current implementation, any non-ASCII characters are encoded in the form u*xxxx*, where *xxxx* is the four-digit UTF8 encoding.
- The JAXB specification states that Step 6 of the algorithm should be skipped if the top-level domain name is not a standard country code or top level domain name. The specification does not further clarify what processing should be done in this case. In the current implementation, the host string of the URI is tokenized with the delimiter ".", even when the string does not end with a top-level domain name or country code.

Table 17–3 lists some examples of package name to namespace mappings.

Table 17–3 Examples of Namespace to Package Name Mappings

Namespace	Package Name
http://toplink.oracle.com	com.oracle.toplink
http://somecompany.jp/	jp.somecompany
http://army.mil/	mil.army
http://oracle/j2ee/ws_example/	oracle.j2ee.ws_example

Table 17–3 (Cont.) Examples of Namespace to Package Name Mappings

Namespace	Package Name
http://www.acme.com/go/espeak.xsd	com.acme.go.espeak
urn:dime/types.xsd	dime.types_xsd

The following lists describe the order in which the mapping algorithm in WebServicesAssembler attempts to map the service endpoint interface, value types, and their related artifacts in the WSDL to Java names and types.

Mapping the WSDL Service Endpoint Interface and Related Endpoint Artifacts to Java Package and Class Names

The following steps represent the order in which the WebServicesAssembler tool attempts to map the service endpoint interface and its related artifacts in the WSDL to Java names.

1. For the service endpoint interface, look up the value of the `<service-interface-mapping>` element in the JAX-RPC mapping file. See "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on this file.
2. Use the value of the `packageName` WebServicesAssembler argument to get the Java package name for the generated classes. See "packageName" on page 17-42 for more information on this argument.
3. Look up the value of the `<package-mapping>` element in the JAX-RPC mapping file.
4. Derive the Java package name from WSDL namespace.

Mapping WSDL Value Types and Related Artifacts to Java Names and Types

The following steps represent the order in which the WebServicesAssembler tool attempts to map the value types and their related artifacts in the WSDL to Java names and types.

1. Look up the `<java-xml-type-mapping>` element in the JAX-RPC mapping file. See "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on this file.
2. If the schema type is defined under the same namespace as the `targetNamespace` of the targeting document (a WSDL or schema), then use the value of the `packageName` WebServicesAssembler argument. See "packageName" on page 17-42 for more information on this argument.
3. Look up the value of the Java `<package-mapping>` element in the JAX-RPC mapping file.
4. Derive the Java package name from the WSDL namespace and the value of the `valueTypePackagePrefix` WebServicesAssembler argument as described in "valueTypePackagePrefix" on page 17-62. See also "Specifying a Root Package Name" on page 17-66 for more information on this argument.

Specifying a Namespace

Use the `typeNamespace` argument to explicitly specify a namespace. The name that you specify will always be used and it will not be reversed.

Specifying a Root Package Name

Use the `valueTypePackagePrefix` argument to specify a root package name for all types in the schema(s) in the specified WSDL. All package names will start with this value. The specified value will be used only if there is no type namespace-to-package mapping declared in the JAX-RPC mapping file.

If the generated package name starts with the same value, it will not be added to the package name. This will avoid packages looking like `com.oracle.mytypes.com.oracle.mytypes`.

Establishing a Database Connection

The aqAssemble, dbJavaAssemble, plsqlAssemble, and sqlAssemble commands require a database connection to generate a Web service. A connection can be made to the database at Web service assembly time and at runtime. At Web service assembly time, the WebServicesAssembler connects to the database to get information on the database entities such as PL/SQL packages or AQ queues. At Web service runtime, the user application uses the data source JNDI location to get the JDBC connection for database operations. WebServicesAssembler ensures that this information will be provided to the Web service runtime code.

The following arguments can be used to provide connection information to a Web service.

- dbUser
- dbConnection
- dataSource

To provide assembly time and runtime access to the database, use either the `dataSource` argument or the `dbConnection` and `dbUser` combination on the command line or in an Ant task.

- The `dbConnection` and `dbUser` arguments usually appear together. They provide the JDBC URL and the database schema and password to WebServicesAssembler for assembly time and runtime access to the database.
- The `dataSource` argument provides the JNDI location that allows WebServicesAssembler to provide assembly time and runtime access to the database.
- If all three arguments appear in an Ant task or on the command line, then the values of `dbConnection` and `dbUser` will be used for assembly time access and `dataSource` will be used for runtime access to the database.

Additional Ant Support for WebServicesAssembler

This section describes additional functionality that is available for WebServicesAssembler through Ant tasks. This functionality is not available on the WebServicesAssembler command line.

- Using Multiple Instances of an Argument in Ant
- Configuring Proxy Generation in an Ant Task
- Configuring a Port in an Ant Task
- Configuring a Port Type in an Ant Task
- Configuring Handlers in an Ant Task

- Adding Files to an Archive
- Controlling a WebServicesAssembler Build

Using Multiple Instances of an Argument in Ant

The following arguments to WebServicesAssembler commands can be declared more than once on the command line or in an Ant task.

- input
- schema
- sqlstatement
- valueTypeClassName

In an Ant task, you must list multiple instances of any of these arguments as separate tags. When they are listed as separate tags, the `input`, `schema`, and `sqlstatement` arguments require a `value` attribute. The `valueTypeClassName` argument requires a `name` attribute.

For example, the following `assemble` command uses multiple instances of the `input` argument to generate an EAR file which includes `first.jar`, `second.jar`, and `third.jar`.

```
<oracle:assemble
          appName="myService"
          output="build">
             <oracle:porttype
               interfaceName="com.myCompany.myService.Hello"
               className="com.mycompany.HelloImpl"
             </oracle:porttype>
             <oracle:input value="first.jar"/>
             <oracle:input value="second.jar"/>
             <oracle:input value="third.jar"/>
</oracle:assemble>
```

The following `jmsAssemble` command uses multiple instances of the `valueTypeClassName` argument to identify class names of the JAX-RPC value types which can be items in `java.util.Collection` and `java.util.Map`.

```
<oracle:jmsAssemble
       linkReceiveWithReplyTo="true"
       targetNamespace="http://oracle.j2ee.ws/jms-doc"
       typeNamespace="http://oracle.j2ee.ws/jms-doc/types"
       serviceName="JmsService"
       appName="jms_service"
       context="jms_service"
       input="./demo/build/mdb_service.jar"
       output="./demo/dist"
       >
         <oracle:valueTypeClassName name="tClass1"/>
         <oracle:valueTypeClassName name="tClass2"/>
         <oracle:valueTypeClassName name="tClass3"/>
</oracle:jmsAssemble>
```

Configuring Proxy Generation in an Ant Task

The `proxy` subtag enables you to generate a client proxy at the same time the server code is assembled. This is most useful during bottom up assembly when the name of

the WSDL is not necessarily known ahead of time. You can use the `proxy` subtag in Ant tasks for the following commands.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- jmsAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble

The `proxy` subtask provides functionality similar to the `genProxy` WebServicesAssembler command. Except for `wsdl`, any of the supported `genProxy` arguments can be used as attributes in the `proxy` subtag.

The `output` argument is supported as an attribute, but is not required as it is for `genProxy`. If `output` is not specified in the `proxy` subtag, then the value of `output` provided for the parent tag will be used with the `src/proxy` directory path appended to it. For example if the parent tag sets `output="build"`, then the output for the proxy subtag will be placed in `build/src/proxy`.

The following arguments can be used as attributes to the proxy subtag.

- classpath
- dataBinding
- ddFileName
- endpointAddress
- genJUnitTest
- mapHeadersToParameters
- mappingFileName
- output
- overwriteBeans
- packageName
- replyToConnectionFactoryLocation
- replyToQueueLocation
- searchSchema
- unwrapParameters
- useDimeEncoding
- valueTypePackagePrefix

Example 17–5 illustrates the use of a `<proxy>` subtag with a `packageName` attribute. In this example, `assemble` is used as the parent tag.

Example 17–5 Using the proxy Subtag in an Ant Task

```
<oracle:assemble...>   (or any command that supports the proxy tag)
  <oracle:proxy packageName="myproxy"/>
</oracle:assemble>
```

Generating Handler and Port Information into a Proxy

You can add message processing information and port-specific information to a proxy by using the `<handler>` and `<port>` tags.

- `<handler>`—to examine and potentially modify a request before it is sent to the remote host, or before the client processes the response, you can configure a `<handler>` tag as a sub tag of `<proxy>`. "Configuring Handlers in an Ant Task" on page 17-71 provides more information on the `<handler>` tag.
- `<port>`—to generate a proxy for a particular port, you can configure a `<port>` tag as a sub tag of `<proxy>`. "Configuring a Port in an Ant Task" on page 17-69 provides more information on the `<port>` tag.

Configuring a Port in an Ant Task

The port identifies the network address of the endpoint hosting the Web service. For some WebServiceAssembler commands, Ant tasks allow you to specify a `port` tag as a child. This enables you to have a different configuration for each port. For example, you can assign two different transports or two different SOAP versions.

These Ant tasks allow you to specify a `port` tag.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- jmsAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble
- genWsdl
- genDDs

These arguments can be used in a `port` tag (note: arguments in the context of Ant tasks are "attributes").

- bindingName
- endpointAddress
- portName (or name)
- replyToConnectionFactoryLocation
- replyToQueueLocation
- sendConnectionFactoryLocation
- sendQueueLocation

- soapVersion
- uri

In addition to these arguments, the `port` tag also enables you to specify a `name` argument which is the local part of the port name.

Within the `port` tag, each command can specify zero or more optional arguments. Each command supports a different subset of arguments. For the list of arguments that can be used for a particular command, see the command's "Additional Ant Support" section.

Example 17–6 illustrates using the `port` tag to specify a JMS and an HTTP transport to different ports. Note that the `port` declaration for the HTTP transport uses the `name` attribute. The `name` attribute is optional if you specify only one `port` in an Ant task. If you specify multiple `port` tags in an Ant task, then the `name` attribute is required.

Example 17–6 Assigning Different Transports to Different Ports

```
<oracle:port
      uri="/echo"
      sendQueue="jms/senderQueue"
      sendConnectionFactoryLocation="jms/senderQueueConnectionFactory"
      replyToConnectionFactoryLocation="jms/receiverQueueConnectionFactory"
      replyToQueue="jms/receiverQueue"/>
<oracle:port uri="echo2" name="EchoHttpPort"/>
```

Example 17–7 illustrates using the `port` tag to specify different SOAP message versions to different ports. When you specify multiple ports in the same Ant task, then each `port` tag will require a `name` attribute:

Example 17–7 Assigning Different SOAP Message Versions to Different Ports

```
<oracle:assemble
   ...
      <oracle:port uri="soap11" soapVersion="1.1" name="httpSoap11Port" />
      <oracle:port uri="soap12" soapVersion="1.2" name="httpSoap12Port" />
   ...
/>
```

Configuring a Port Type in an Ant Task

Some Ant tasks allow you to specify a `porttype` tag as a child task. This enables you to configure different interfaces to a Web service. The Ant tasks for these WebServicesAssembler commands allow you to specify `porttype` as a child task:

- assemble
- genDDs
- genWsdl
- topDownAssemble

A `porttype` tag must have an `interfaceName` argument to identify the interface to the Web service. If you are specifying multiple `<porttype>` tags, then each tag must contain a `<port>` subtag. For more information on `port` tags, see "Configuring a Port in an Ant Task" on page 17-69.

When configuring a `porttype` with the `assemble`, `topDownAssemble`, `genDDs`, and `genWsdl` commands, you must specify a `className` attribute. For the

assemble and topDownAssemble commands, you can specify a classFileName attribute instead of a className attribute.

Additionally, for the topDownAssemble command, if the WSDL contains references to multiple port types, then you must specify a <porttype> tag for each port type.

Table 17–4 summarizes the valid attributes and subtags that can be used with the <porttype> tag.

Table 17–4 Attributes and Subtags for the <porttype> Tag

Attributes and Subtags	Description
classFileName attribute	This attribute can be specified for the assemble and topDownAssemble commands if a className is not specified. It identifies the Java file name of the implementation class specified in the className argument.
className attribute	This attribute is required for the assemble, topDownAssemble, genDDs, and genWsdl commands. It specifies the name of the class (including the package name) that is the implementation class for the Web service.
interfaceName attribute	An interfaceName attribute is required. It identifies the interface to the Web service.
<port> subtag	A <port> subtag is required if you are specifying multiple <porttype> tags. It identifies the port to which the Web service interface applies. If you are specifying only one <porttype> tag, then a <port> tag is not required.

Example 17–8 illustrates assigning a port type to a Web service.

Example 17–8 Associating a Port Type to a Web Service

```
...
<oracle:porttype
   interfaceName="my.company.MyInterface"
   className="my.company.MyImpl">
</oracle:porttype>
...
```

Configuring Handlers in an Ant Task

This section has the following subsections.

- Attributes and Child Tags for handler Tags
- Sample Handler Configuration
- Ant Tasks that Can Configure Handlers
- Configuring Multiple Handlers in an Ant Task

WebServicesAssembler lets you configure handlers and client handlers in Ant tasks. You can use the Ant tasks to configure all of the information defined for handlers by the Enterprise Web Services 1.1 specification.

> **Note:** Handlers and client handlers can be declared and configured only in Ant tasks. They cannot be declared or configured on the command line.

A handler can examine and potentially modify a request, response, or fault before it is processed by a Web service component. It can also examine and potentially modify the response or fault after the component has processed the request. A client handler, as its name implies, runs on the client before the request is sent to the remote host, and before the client processes the response.

The `handler` tag defines a handler in a WebServicesAssembler Ant task. Attributes define details about the handler. These tags and attributes correspond to the `<handler>` tag and its sub-elements defined by the Enterprise Web Services 1.1 specification. Declaring a handler and its attributes in an Ant task will set corresponding elements in `webservices.xml`.

Attributes and Child Tags for handler Tags

The following sections describe the attributes and child tags that can be used with the `handler` tag.

- class attribute
- initparam child tag
- name attribute
- soapheader child tag
- soaprole attribute

class

`class="`*`class_name`*`"`
This attribute defines a fully-qualified class name for the handler implementation.

Using this attribute sets the `<handler-class>`*`class_name`*`</handler-class>` element in `webservices.xml`.

initparam

`<oracle:initparam name="`*`myName`*`" value="`*`myValue`*`" />`
This child tag defines a name-value pair that a handler can use as an initialization parameter. The `name` attribute contains the name of a parameter. Each parameter name must be unique in the Web application. The `value` attribute contains the value of the corresponding parameter.

You can define multiple `initparam` declarations as children of a `handler` Ant task invocation.

Using the `initparam` child tag sets the following `<init-param>` structure in `webservices.xml`.

```
<init-param>
    <param-name>myName</param-name>
    <param-value>myValue</param-value>
</init-param>
```

name

`name="`*`handler_name`*`"`
This attribute defines the name of the handler. The name must be unique within the module.

Using this attribute sets the `<handler-name>`*`handler_name`*`</handler-name>` element in `webservices.xml`.

soapheader

`<oracle:soapheader value="{namespace_URI}local_part"/>`
This child tag defines the `QName` of a SOAP header that will be processed by the handler. The `value` attribute takes a local part of a `QName` and a namespace URI. You can define multiple `soapheader` declarations as children of a `handler` Ant task.

The value of the `soapheader` child tag is written to the `soap-header` tag in `webservices.xml`. For example, if the namespace URI is `http://oracle.j2ee.ws/Header` and the local part is `authenticateHeader`, then the `soapheader` child tag has the following value.

```
<oracle:soapheader value="{http://oracle.j2ee.ws/Header}authenticateHeader"/>
```

This value will have the following representation in the `webservices.xml` file.

```
<soap-header
xmlns:wsa1="http://oracle.j2ee.ws/Header">wsa1:authenticateHeader</soap-header>
```

In this example, `wsa1` is a unique prefix for the given namespace.

soaprole

`soaprole ="Some_SoapRole"`
This attribute defines a SOAP-actor that the handler will play as a role.

Using this attribute sets the `<soap-role>`*Some_SoapRole*`</soap-role>` element in `webservices.xml`.

Sample Handler Configuration

To illustrate how to construct a handler configuration that can be used in an Ant task, Example 17–9 provides a sample configuration for the `StaticStateHandlerName` handler. The handler in implemented by the `myApp.handler.StaticStateHandler` class, and it requires two initialization parameters, `SCOTT` and `TIGER`. The handler will process two types of SOAP headers: `authenticateHeader` and `authenticateHeader2`.

Example 17–9 A Sample Handler Configuration

```
<some tag that supports handlers>
 <oracle:handler soaprole="Some_SoapRole"
   name="StaticStateHandlerName"
   class="myApp.handler.StaticStateHandler">
        <oracle:initparam name="id" value="SCOTT"/>
        <oracle:initparam name="password" value="TIGER"/>
   <oracle:soapheader value="{http://oracle.j2ee.ws/Header}authenticateHeader"/>
   <oracle:soapheader value="{http://oracle.j2ee.ws/Header2}
authenticateHeader2"/>
 </oracle:handler>
</some tag that supports handlers>
```

Ant Tasks that Can Configure Handlers

The Ant tasks for the following WebServiceAssembler commands allow you to specify a `handler` tag as a child task.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble

- ejbAssemble
- jmsAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble
- genProxy
- genDDs (can specify a `handler` tag for the server side only)

Configuring Multiple Handlers in an Ant Task

You can specify multiple handlers for any command that supports handlers. Each handler can have a different configuration.

Example 17–10 illustrates a multiple handler configuration. The parent tag can be any tag which supports handlers.

- The first handler tag configures the `StaticStateHandlerName` handler. The handler is implemented by the `myApp.handler.StaticStateHandler` class, and it requires two initialization parameters, `SCOTT` and `TIGER`. The handler will process two types of SOAP headers: `authenticateHeader` and `authenticateHeader2`.
- The second handler tag shows a very basic handler tag. It configures the `MyOtherHandler` handler that is implemented by the `myapp.handler.MyOtherHandler` class.

Example 17–10 Sample Multiple Headers

```
<some tag that supports handlers>
   <handler soaprole="Some_SoapRole" name="StaticStateHandlerName"
        class="myApp.handler.StaticStateHandler">
     <initparam name="id" value="SCOTT"/>
     <initparam name="password" value="TIGER"/>
     <soapheader namespace="http://oracle.j2ee.ws/Header"
          localpart="authenticateHeader"/>
     <soapheader namespace="http://oracle.j2ee.ws/Header2"
         localpart="authenticateHeader2"/>
   </handler>
   <handler name="MyOtherHandler" class="myApp.handler.MyOtherHandler"/>
</some tag that supports handlers>
```

Adding Files to an Archive

To add a file to an EAR or WAR archive, copy the file to the directory that WebServicesAssembler uses as a staging area where it jars the archive before calling the `*Assemble` task. Figure 17–1 illustrates the layout of the staging area.

The default staging area is *<output>*`/war` for a WAR archive and *<output>*`/ear` for an EAR archive. The *<output>* variable indicates the value of the `output` argument. For example, if the value of the `output` argument is `outputDir`, then the files are stored in `outputDir/war` and `outputDir/ear`.

For example, the following Ant task will place a key store `oraks.jks` into the generated EAR.

```
<copy file="oraks.jks" todir="build/ear/META-INF/>
<oracle:assemble output="build"
```

```
                    ...
/>
```

Controlling a WebServicesAssembler Build

WebServicesAssembler provides a Boolean `failonerror` argument that will allow you to continue a build even though there are errors. If the value of `failonerror` is `true`, the build fails if WebServicesAssembler encounters an error. If the value is `false`, then the build will continue. The default value is `true`.

The `failonerror` argument can be used with any WebServicesAssembler command. In the following example, WebServicesAssembler will continue to process if the assemble command encounters an error.

```
<oracle:assemble failonerror="false"
          ...
/>
```

Assigning Multiple Web Services to an EAR or WAR Archive

To assign multiple Web services in a single archive (EAR or WAR) the `assemble` or `topDownAssemble` task must be called for each Web service that is going in the WAR. The arguments defined for each assemble task must follow these rules.

- All `output` arguments must have the same value.
- Only the last `assemble` task can define an `ear` argument. The reason for this is when an `ear` argument is specified, the contents of the WAR staging directory (`/war`) will be archived and put in the EAR. When an archive is created, the files in the staging area are deleted.
- The `war` argument for all tasks except the last, must have the same value as the `output` argument with the directory name `/war` appended to it. This is because WebServicesAssembler's default behavior is to use the output directory, *directory*`/war`, as the staging area for the WAR. For example, if the `output` argument is set to `dist` then the `war` argument should be set to `dist/war`.
- All tasks except the first must set `appendToExistingDDs` to `true`. The first `assemble` task can set `appendToExistingDDs` to `true` only if the output *directory*`/war`, already contains deployment descriptors that you want WebServicesAssembler to modify (for example a `web.xml` with resource references).
- The last `assemble` task should not define a `war` argument unless you want WebServicesAssembler to create a WAR instead of an EAR.
- The `appName` argument must be unique in all of the `assemble` tasks.
- If a `uri` argument is specified it must be unique in all of the `assemble` tasks.

Example 17–11 displays the Ant tasks to assign two Web services, `firstApp` and `nextApp` to the `myApps.ear` EAR file. Note the following details in the example code.

- the `output` arguments for the two assemble commands are assigned the same value for the output directory path: `${out.dir}`.
- the first `assemble` command stores its output in a `/war` directory, while the last `assemble` argument specifies the EAR file that will store the two Web services.

- the last Web service specifies the `appendToExistingDDs` so that its deployment descriptor will be appended to the descriptor generated by the previous command.

The ellipsis indicates additional Ant commands.

Example 17–11 Ant Tasks to Assign Two Web Services to an EAR

```
<oracle:assemble appName="firstApp"
          output="${out.dir}"
          war="${out.dir}/war"
            ...
          />
      <oracle:assemble appName="nextApp"
          output="${out.dir}
          appendToExistingDDs="true"
          ear="myApps.ear"
            ...
          />
```

Example 17–12 displays the Ant tasks to assign three Web services, `firstApp`, `nextApp`, and `lastApp` to the `myApps.ear` EAR file. Note the following details in the example code.

- the `output` arguments for the three `assemble` commands are assigned the same value for the output directory path: `${out.dir}`.
- the first two `assemble` commands store their output in a `/war` directory, while the last `assemble` argument specifies the EAR file that will store the three Web services.
- the second and last Web services also specify the `appendToExistingDDs` so that their deployment descriptors will be appended to the descriptor generated by the previous command.

The ellipsis indicates additional Ant commands.

Example 17–12 Ant Tasks to Assign Three Web Services to an EAR

```
<oracle:assemble appName="firstApp"
          output="${out.dir}"
          war="${out.dir}/war"
            ...
          />
      <oracle:assemble appName="nextApp"
          output="${out.dir}
          appendToExistingDDs="true"
          war="${out.dir}/war"
            ...
          />
      <oracle:assemble appName="lastApp"
          output="${out.dir}
          appendToExistingDDs="true"
          ear="myApps.ear"
            ...
          />
```

Limitations on Assigning Multiple Web Services to a WAR File

WebServicesAssembler does not check for conflicts when adding multiple Web services to a single WAR. The following conflicts will cause an invalid assembly that will not be detected until deployment time or runtime.

- The different Web services contain WSDL files that have the same name.

  If the WSDL files in different Web services have the same name, then one of the WSDL files will overwrite the others. To avoid this conflict, ensure that WSDL file names in different Web services are unique.

- The different Web services contain class files that have the same name.

  If class files use the same name (including package name) in different Web services, then one of the classes will overwrite the other. In some cases, these files really are the same. For example, value type classes from the same schema types can be shared between two different services. This type of conflict will not cause a problem.

  Classes that cannot be the same include the service endpoint interface and the implementation class. If the class files are not the same, then they should either be renamed or placed in a different package.

Representing Java Method Parameter Names in the WSDL

When you are generating a Web service bottom up from Java classes or EJBs, WebServicesAssembler generates a WSDL. For a Java method's `<element name="..." />` attribute in the generated WSDL, WebServicesAssembler attempts to use the method's actual parameter names. Using the method's actual parameter names in the WSDL and SOAP messages makes it easier for you to determine which parameter corresponds to which element.

WebServicesAssembler uses these techniques to attempt to retrieve the method's parameter names in the following order.

1. If the interface source file is provided, WebServicesAssembler will parse the code for parameter names. To do this, the full path name of the Java interface file must be specified with the `interfaceFileName` argument.
2. If the interface source file is not provided, WebServicesAssembler will attempt to load and parse the Java class file that implements the methods in the interface. To be able to extract the parameter names, the class file must have been compiled with the `-g` option to `javac`.

If these techniques fail to retrieve the parameter names, or if the class is not loadable or obfuscated, then WebServicesAssembler uses the parameter's datatype and a number (for example, `string_1`) by default.

Example 17–13 and Example 17–14 provide WSDL fragments that represent the following method.

```
public String sayHello(String name)
```

Example 17–13 illustrates a WSDL fragment where WebServicesAssembler was able to retrieve the `sayHello` method's parameter name. The `<element name="..."/>` attribute and its value are highlighted in bold.

Example 17–13 WSDL Fragment With a Generated Parameter Name

```
<definitions name="HelloService" targetNamespace="http://hello.demo.oracle/">
    <types>
```

```
    <schema elementFormDefault="qualified"
targetNamespace="http://hello.demo.oracle/">
    <complexType name="sayHello">
       <sequence>
          <element name="name" nillable="true" type="string"/>
       </sequence>
    </complexType>
...
```

Example 17–14 illustrates a WSDL fragment where the `sayHello` method's parameter name could not be determined. WebServicesAssembler uses `string_1` value for the element name attribute. The `<element name="..."/>` attribute and its value are highlighted in bold.

Example 17–14 WSDL Fragment With a Default Parameter Name

```
<definitions name="HelloService" targetNamespace="http://hello.demo.oracle/">
    <types>
    <schema elementFormDefault="qualified"
targetNamespace="http://hello.demo.oracle/">
    <complexType name="sayHello">
       <sequence>
          <element name="string_1" nillable="true" type="string"/>
       </sequence>
    </complexType>
...
```

Limitations

See "Using WebServicesAssembler" on page C-7.

Additional Information

For more information on:

- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".
- assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".
- assembling REST Web services, see Chapter 11, "Assembling REST Web Services".
- building J2EE clients, see Chapter 13, "Assembling a J2EE Web Service Client".
- building J2SE clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- packaging and deploying Web services, see Chapter 18, "Packaging and Deploying Web Services".

- JAR files that are needed to assemble a client, see Appendix A, "Web Service Client APIs and JARs".
- Web services interoperability, see "Ensuring Interoperable Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- how to write clients to access Web services secured on the transport level, see "Adding Transport-level Security for Web Services Based on EJBs" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- processing nonstandard data types, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using the JAX-RPC mapping file and its contents, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- data types supported by OracleAS Web Services, see "Mapping Java Types to XML and WSDL Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- using the Web Service Invocation Framework, see "Using Web Services Invocation Framework" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- JDeveloper tool support for Web service development, see the JDeveloper on-line help.

18

Packaging and Deploying Web Services

This chapter describes the packaging of Web service files and deployment support offered by Oracle Application Server Web Services. Except for a few details, Web services are packaged and deployed in the same manner as any other J2EE application.

This chapter does not describe deployment itself. The deployment of Web modules and EJBs is covered in detail in the Oracle Containers for J2EE Deployment Guide. For more information, see the *Oracle Containers for J2EE Deployment Guide*.

Web service files can be assembled and packaged by using either JDeveloper or WebServicesAssembler. The tools ensure that the correct files and deployment descriptors are included for the packaged application. Options in JDeveloper wizards and arguments to WebServicesAssembler commands allow you to configure values in the deployment descriptors that the Web service will use at runtime. The files are packaged into a deployable EAR file according to the rules outlined in the Enterprise Web Services 1.1 specification.

You can also assemble and package a Web service application by hand. Although this chapter describes Web service package structure and contents, it does not describe the details of manual assembly.

Deployment can be performed by using `admin_client.jar` on the command line, Ant tasks, or by using the JDeveloper or Application Server Control tools.

Table 18–1 summarizes the Oracle tools that can perform Web service packaging and deployment.

Table 18–1 Packaging and Deployment Support Offered by Oracle Tools

	WebServices-Assembler	JDeveloper	Application Server Control	admin_client.jar	Ant Tasks
Packaging	Yes	Yes	No	No	No
Deployment	No	Yes	Yes	Yes	Yes

As a final step, you can publish your deployed Web service to the Universal Description, Discovery, and Integration (UDDI) registry. Discussion of UDDI is beyond the scope of this documentation. For more information about working with UDDI, see the following Web address.

`http://www.uddi.org/specification.html`

This chapter has the following sections.

- Packaging Web Service Applications
- Tool Support for Packaging

Packaging Web Service Applications

The Web service files which are intended for deployment to OC4J are included in a component deployment module. This component deployment module can be a JAR file for an EJB or a WAR file for Java classes. The component deployment module is then stored in a deployable EAR. The following sections provide more detail on the packaging of Web service files.

Packaging Structure for Web Service Applications

The package structure for Web service files in an EAR file follows the rules defined by the Enterprise Web Services 1.1 specification. The following sections describe the packaging structure for Web services based on Java classes and EJBs.

Packaging for a Web Service Based on Java Classes

For a Web service based on Java classes, the EAR file contains a WAR file. The deployment and class files reside under the `WEB-INF` directory in the WAR. The `WEB-INF` directory contains the `web.xml`, `webservices.xml`, `oracle-webservices.xml`, and the JAX-RPC mapping file. It also contains a `classes` directory for the class files, a `lib` directory for the JAR files, and a `wsdl` directory for the WSDL.

The `META-INF` directory contains the `MANIFEST.MF` manifest file which defines extension and package related data and the `application.xml` file which specifies the components of a J2EE application.

Example 18–1 illustrates the packaging structure for a Web service based on Java classes.

Example 18–1 Packaging Structure for a Web Service Based on Java Classes

```
<serviceName>.ear        contains
      META-INF/
         |--MANIFEST.MF
         |--application.xml

      <serviceName>.war  contains
          WEB-INF/
             |--web.xml
             |--webservices.xml
             |--oracle-webservices.xml
             |--<mapping file>
             |--wsdl/
                  |--<serviceName>.wsdl
             |--classes/
                  |--class files
```

```
            |--lib/
                 |--*jar files
```

Packaging for a Web Service Based on EJBs

The packaging structure for a Web service based on EJBs is similar to Java classes, except the EAR file contains a `META-INF` directory for the manifest and a JAR file. Within the JAR file is another `META-INF` directory which contains the deployment and class files for the EJB. The `META-INF` directory within the JAR contains the `ejb-jar.xml`, `webservices.xml`, `oracle-webservices.xml`, and the JAX-RPC mapping file. It also contains the class files and a `wsdl` directory for the WSDL. Example 18–2 illustrates the packaging structure for a Web service based on EJBs.

Example 18–2 Packaging Structure for a Web Service Based on EJBs

```
<serviceName>.ear  contains
        META-INF/
           |--MANIFEST.MF
           |--application.xml

        <serviceName>.jar contains
              class files
              META-INF/
                  |--ejb-jar.xml
                  |--webservices.xml
                  |--oracle-webservices.xml
                  |--<mapping file>
                  |--wsdl/
                       |--<serviceName>.wsdl
```

Description of Packaged Files

The following list describes the files that are packaged for deployment.

- `application.xml`—describes all of the WARs and EJB JARs in the EAR. It specifies the components of a J2EE application, such as EJB and Web modules, can specify additional configuration for the application as well. This descriptor must be included in the `/META-INF` directory of the application's EAR file. The `application.xml` file is defined by the `application_1_4.xsd` schema located at the following Web site.

  `http://java.sun.com/xml/ns/j2ee/application_1_4.xsd`

- `ejb-jar.xml`—the deployment descriptor for an EJB component. It defines the specific structural characteristics and dependencies of the Enterprise JavaBeans within a JAR, and provides instructions for the EJB container about how the beans expect to interact with the container.

  There is a relationship between the contents of `webservices.xml` and `ejb-jar.xml` to identify the EJB exposed as a Web service. Figure 18–1 illustrates this relationship.

  The `ejb-jar.xml` file is defined by the schema located at the following Web site.

  `http://java.sun.com/xml/ns/j2ee/ejb-jar_2_1.xsd`

- *<mapping file>*`.xml` (for example, *serviceName*`_java-wsdl-mapping.xml`)—the JAX-RPC mapping file that maps Java interfaces, methods, and parameters to the WSDL. For more information on this file, see *JAX-RPC Mapping File Descriptor* in the *Oracle Application Server Advanced Web Services Developer's Guide*.

- `oracle-webservices.xml`—a deployment descriptor that defines deployment properties specific to a Web service application running on OracleAS Web Services. For more information on the contents of this file, see "oracle-webservices.xml Deployment Descriptor" on page 18-12.
- `web.xml`—this deployment descriptor is defined by the Java Servlet 2.4 specification. This deployment descriptor can be used to deploy a Web application on any J2EE-compliant application server. For more information on the `web.xml` file, see the Java Servlet 2.4 specification at the following Web site.

  `http://jcp.org/aboutJava/communityprocess/final/jsr154/index.html`

  There is a relationship between the contents of `webservices.xml` and `web.xml` to identify the servlet exposed as a Web service. Figure 18–2 illustrates this relationship.

  The `web.xml` file is defined by the `web-app_2_4.xsd` schema located at the following Web site:

  `http://java.sun.com/xml/ns/j2ee/`

- `webservices.xml`—a standard configuration file for a Web Service application packaged within a component deployment module. It defines the Web service endpoint, associated configuration files, WSDL information, and JAX-RPC mapping data. It provides the location of the WSDL file (`<wsdl-file>`), the mapping file (`<jaxrpc-mapping-file>`), the `<port-component>` corresponding to the ports in the WSDL, the Java service endpoint interface (`<service-endpoint-interface>`), the Java representation of the WSDL, and the servlet name (`<servlet-link>`) or EJB name (`<ejb-link>`).

  There is a relationship between the contents of `webservices.xml` and the `ejb-jar.xml`, `oracle-webservices.xml`, and `web.xml` files. These relationships identify the component being exposed as a Web service and to pass metadata between files. "Relationships Between Deployment Descriptor Files" provides more information on these relationships.

  The `webservices.xml` file is defined by the `j2ee_web_services_1_1.xsd` schema located at the following Web site:

  `http://java.sun.com/xml/ns/j2ee/`

- WSDL file—describes the interface of the Web service and the format of the messages used to invoke it. If an archive containing a Web service does not include a Web Services Description Language (WSDL) document, OracleAS Web Services will generate a WSDL document at deployment time. The WSDL is defined by the specification located at the following Web site.

  `http://www.w3.org/TR/wsdl`

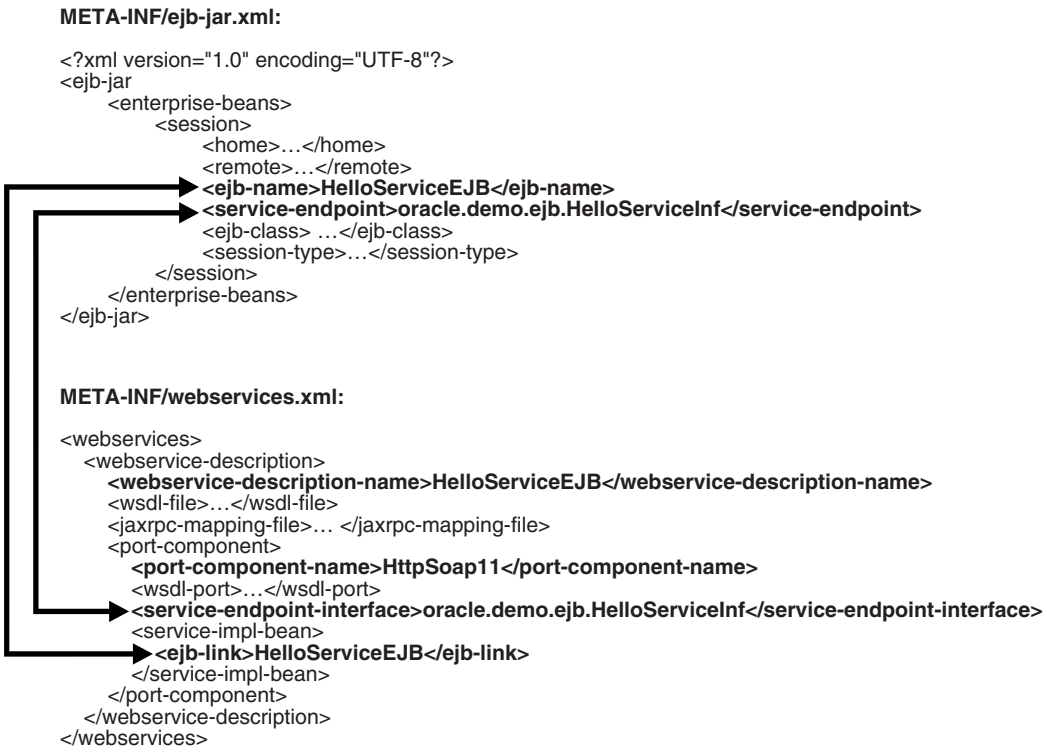
Relationships Between Deployment Descriptor Files

This section illustrates the relationships between the `webservices.xml` file and the `ejb-jar.xml`, `oracle-webservices.xml`, and `web.xml` files.

webservices.xml and ejb-jar.xml Figure 18–1 illustrates the relationship between the contents of `webservices.xml` and `ejb-jar.xml` for Web services based on EJBs. The `<ejb-link>` element in `webservices.xml` provides the same value as `<ejb-name>` in `ejb-jar.xml`. This mapping identifies the EJB that is to be exposed as a Web service and hence over HTTP (SOAP over HTTP). The `<service-endpoint-interface>` element in `webservices.xml` provides the

same value as <service-endpoint> element in ejb-jar.xml. This serves as an additional uniqueness constraint on the EJB.

Figure 18–1 Relationship Between webservices.xml and ejb-jar.xml

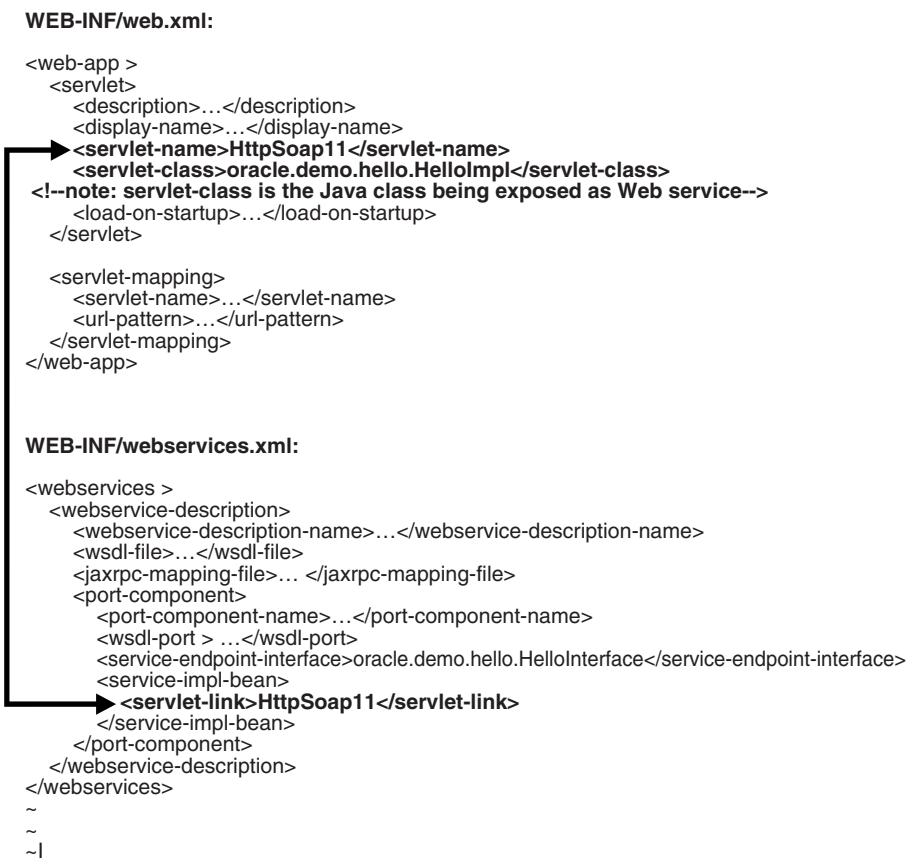


webservices.xml and oracle-webservices.xml Figure 18–2 illustrates the relationship between the contents of the J2EE standard webservices.xml deployment descriptor and the oracle-webservices.xml proprietary deployment descriptor. This relationship allows metadata to be mapped between files. The <port-component-name> element in webservices.xml provides the same value as the name attribute in <port-component name="..."> in oracle-webservices.xml. The <webservice-description-name> element in webservices.xml provides the same value as the name attribute in <webservice-description name="..."> in oracle-webservices.xml.

Figure 18–2 Relationship Between webservices.xml and oracle-webservices.xml

webservices.xml and web.xml Figure 18–3 illustrates the relationship between the contents of `webservices.xml` and `web.xml` to identify the servlet that is to be exposed as a Web service The `<servlet-link>` element in `webservices.xml` provides the same value as the `<servlet-name>` present in `web.xml`. This allows the Web service implementation to be exposed as a servlet and hence over HTTP (SOAP over HTTP). This generalized approach allows application packages to be portable across J2EE containers implementing JAX-RPC and the Enterprise Web Services 1.1 specification. An application adhering to these standards can be deployed to any container that complies with the Enterprise Web Services 1.1 specification and can be invoked using any Web service client.

Figure 18–3 Relationship Between webservices.xml and web.xml



Tool Support for Packaging

This section describes the tool support for packaging Web service files offered by OracleAS Web Services. Packaging can be performed by WebServicesAssembler and by JDeveloper.

- Packaging Support with WebServicesAssembler
- Packaging Support with JDeveloper

Packaging Support with WebServicesAssembler

This section describes the packaging support offered by WebServicesAssembler. The commands that assemble a Web service also package it in a deployable EAR file. In the course of assembling the files, many of these commands also create the deployment descriptors. The deployment descriptors contain the declarative data required to deploy the components as well as the assembly instructions that describe how the components are composed into an application.

- WebServicesAssembler Packaging Commands
- Managing Deployment Descriptors

WebServicesAssembler Packaging Commands

WebServicesAssembler provides several commands that assemble all of the files needed for a Web service.

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- jmsAssemble
- plsqlAssemble
- sqlAssemble

WebServicesAssembler handles the generation of all relevant deployment descriptors and maps the proprietary configuration needed by the applications into Oracle-specific deployment files. It also packages all of the relevant files so that they can be deployed to an application server. For more information on these commands, see "Web Service Assembly Commands" on page 17-3.

These commands support arguments that let you package or save the generated files in a number of ways. The `ear` argument saves the files as a deployable EAR file. The `war` argument saves the files as a WAR file. The files can also be saved un-archived, in a directory that contains the contents of a WAR. For more information on these arguments, see "ear" on page 17-38 and "war" on page 17-45.

Managing Deployment Descriptors

A number of WebServicesAssembler commands create deployment descriptors in the course of assembling a Web service. WebServicesAssembler does not perform deployment, but arguments to WebServicesAssembler commands will allow you to set values in the deployment descriptors.

- Creating Deployment Descriptors
- Arguments that Affect Deployment Descriptor Contents

Creating Deployment Descriptors Several of the WebServicesAssembler commands generate the `application.xml`, `web.xml`, `webservices.xml`, and `oracle-webservices.xml` deployment descriptors as part of their output. The commands that generate these files are:

- aqAssemble
- assemble
- corbaAssemble
- dbJavaAssemble
- ejbAssemble
- jmsAssemble
- plsqlAssemble
- sqlAssemble
- topDownAssemble
- genApplicationDescriptor (generates `application.xml` only)
- genDDs

Arguments that Affect Deployment Descriptor Contents Calling WebServicesAssembler commands with the following arguments will affect the content of elements in the following deployment descriptors.

application.xml:

- context—when used for web applications, adds the `<context-root>` element.

oracle-webservices.xml:

- callScope—adds the `<param name="scope">call</param>` element.
- context—when used for EJB 2.1, adds the `<context-root>` element.
- dataSource—adds the following `param name` attribute to the `<implementor>` element. In the following example, *dataSource value* is the value specified for the `dataSource` argument.

  `<param name="databaseJndiName">`*dataSource value*`</param>`
- ddFileName—when used with the `*Assemble` commands, management and custom serialization information will be copied from the specified file to the `oracle-webservices.xml` file in the archive.
- restSupport—adds a Boolean `<rest-support>` subelement to the `<port-component>` element and the `<provider-port>` element.
- session—adds the `<param name="scope">session</param>` element.
- timeout—adds the `<param name="session-timeout">`*integer*`</param>` element.
- uri—when used for EJB 2.1, adds the `<endpoint-address-uri>` element.
- useDimeEncoding—adds the `<use-dime-encoding>` element.

query-java-wsdl-mapping.xml:

- interfaceName—when used with the commands to assemble a Web service from database resources (`plsqlAssemble`, `sqlAssemble`, `dbJavaAssemble`, or `aqAssemble`) adds the `<service-endpoint-interface>` element.

web.xml:

- className—adds the `<servlet-class>` element.
- recoverable—adds a Boolean `<distributable>` element.
- uri—when used for web applications, adds the `<url-pattern>` element.

webservices.xml:

- ejbName—adds the `<ejb-link>` element to `webservices.xml` for EJB 2.1 only.
- interfaceName—adds the `<service-endpoint-interface>` element.
- mappingFileName—adds the `<jaxrpc-mapping-file>` element. Note that the location and name of the file may be changed when put in the deployment descriptor. The contents of the file may be modified before being placed in the archive if some mappings were not defined in the original file.
- `<handler>` tags—the data in handler tags are added to `webservices.xml`. These tags can be used only in Ant tasks.

Packaging Support with JDeveloper

JDeveloper provides wizards that can package your Web service application for deployment. For more information on the support offered by JDeveloper, see the following topics in the JDeveloper on-line help.

- *About J2EE Archive Formats*

  Lists the archive types and their associated module types and contents, as supported by JDeveloper.

- *Configuring Applications for Deployment*

  Provides links to topics dealing with the configuration and packaging of deployment descriptors, client applications, EJBs, and applets.

- *Configuring EJBs for Deployment*

  Takes you through the steps of creating a EJB JAR File deployment profile and adding an `ejb-jar.xml` deployment descriptor.

- *Configuring a Client Application for Deployment*

  Takes you through the steps of creating a client JAR file deployment profile and creating the `application-client.xml` deployment descriptor file.

- *Configuring an Applet for Deployment*

  Takes you through the steps of creating a WAR File deployment profile and adding a `web.xml` deployment descriptor.

Understanding Web Service Deployment

Deployment is the process which transfers application files to the server where the application will run. The deployment of Web modules and EJBs is covered in detail in the following chapters of the *Oracle Containers for J2EE Deployment Guide*.

- For guidelines on deploying WAR files into OracleAS Web Services, see "Deploying Web Modules".
- For guidelines on deploying EJB archives, see "Deploying Enterprise JavaBeans".
- For guidelines on deploying applications from the command line, see "Deploying Applications with admin_client.jar".
- For guidelines on deploying applications from Ant tasks, see "Deploying with the OC4J Ant Tasks".

Web services can be deployed by using JDeveloper or Application Server Control. You can also deploy Web services by using Ant tasks or by using `admin_client.jar` on the command line. For more information on using these tools for deployment, see "Tool Support for Deployment".

Tool Support for Deployment

This section describes the tool support for deployment offered by OracleAS Web Services. Deployment can be performed through the command line, JDeveloper, and Application Server Control.

- Deployment Support with Application Server Control

Command Line Support for Deployment

The `admin_client.jar` command-line utility provided with OC4J can be used to deploy Web services packaged within an EAR file. You may want to use this utility if you plan to script the application deployment process. However, deploying standalone modules, such as a Web module packaged in a WAR file, is not supported using `admin_client.jar`.

See "Deploying Applications with admin_client.jar" in the *Oracle Containers for J2EE Deployment Guide* for instructions on deploying applications with this tool.

A Sample Deployment Using admin_client.jar

An EAR file containing files for a Web service can be deployed in the same way as other J2EE applications. The following is a sample deployment command.

```
java -jar <oc4jHome>/j2ee/home/admin_client.jar
deployer:oc4j:<oc4jHost>:<oc4jOrmiPort> <adminId><adminPassword>
            -deploy
            -file dist/hello.ear
            -deploymentName hello
            -bindWebApp default-web-site
```

The following list describes the parameters in this code example.

- *<oc4jHome>*—The directory containing the OC4J installation.
- *<oc4jHost>*:*<oc4jOrmiPort>*—The host name and port of the OC4J server to which you are deploying the EAR file or J2EE application.
- *<adminId>*—The user name for the OC4J instance. The user assigns this value when OC4J is installed.
- *<adminPassword>*—The password for the OC4J instance. The user assigns this value when OC4J is installed.
- `default-web-site` —The Web site to which the application will be bound. This is usually `default-web-site`. To configure Web sites, see the `server.xml` file in *<oc4jHome>*`/j2ee/home/config`.

Ant Task Support for Deployment

OracleAS Web Services provides a set of Ant tasks for deploying and undeploying J2EE applications and modules to an OC4J instance. "Deploying with the OC4J Ant Tasks" in the *Oracle Containers for J2EE Deployment Guide* describes the Ant tasks and provides guidelines for integrating the tasks into your application build process. This chapter includes the following topics.

- "Incorporating the OC4J Ant Tasks into the Build Environment" outlines the procedure for incorporating the OC4J Ant tasks into the build environment.
- "Invoking the OC4J Ant Tasks" includes descriptions of how to invoke the following Ant tasks:
  - deploy task—The `deploy` task deploys a J2EE application or module packaged in an archive.
  - bindWebApp task—The `bindWebApp` task binds the application to the Web site that will be used to access it.

  - undeploy task—The `undeploy` task removes the specified application or module from the OC4J instance. This task also unbinds the application from the Web site automatically.

Deployment Support with JDeveloper

The following list describes the topics available in the JDeveloper online help for deploying Web services. For more information on each of these topics, see the JDeveloper on-line help

- *Simple JAR Deployment*

  Takes you through the steps of deploying your application to an executable JAR file, or a JAR file on your file system.

- *Deploying Web Services to Embedded OC4J*

  Takes you through the steps of deploying your Web service to Oracle Application Server or an embedded instance of OC4J that runs on your local server.

- *Deploying Web Services to External OC4J*

  Takes you through the steps of deploying your Web service to Oracle Application Server or an external instance of OC4J that runs on a remote server.

- *Deploying Secure Oracle Application Server Web Services*

  Takes you through the steps of deploying a J2EE 1.4 Web service that uses security. The steps describe how to bundle the keystore with the Web service for deployment.

Deployment Support with Application Server Control

The following list describes the topics available in the Application Server Control on-line help for deploying Web services. For more information on each of these topics, see the Application Server Control on-line help

- *Deploy: Deployment Settings Page*

  The deployment plan page provided with the Application Server Control Console includes the ability to set values in the OracleAS Web Services deployment descriptor (`oracle-webservices.xml`) at deployment time.

- *Deploy: Application Attributes Page*

  Describes the deployment attributes that you can configure by using Application Sever Control.

- *Deploying an Application*

  Takes you through the steps of deploying an application.

- *Redeploying and Undeploying Applications*

  Takes you through the steps of redeploying or undeploying an application.

oracle-webservices.xml Deployment Descriptor

The `oracle-webservices.xml` deployment descriptor is used in conjunction with the standard `webservices.xml`. It contains deployment and run-time information that is specific to OracleAS Web Services. For example, it contains the context-URI, the Web service end-point address, and so on. All of the elements in

`oracle-webservices.xml` are optional. If the file is not provided, the application will still deploy and run, with appropriate default values for the unspecified elements.

Although you could manually create `oracle-webservices.xml` by examining the schema, you will typically use the version of the file created by WebServicesAssembler. You can edit this file to produce the functionality you want.

The `oracle-webservices.xml` deployment descriptor contains the Web services management information for security, reliability, auditing, and logging. On deployment, the file is parsed and its object representation is cached. The Web service management information is extracted from the file and saved as `wsmgmt.xml` in the OC4J container.

Components in oracle-webservices.xml

The following sections describe the configuration elements in the `oracle-webservices.xml` deployment descriptor. Some elements in the file can be changed by WebServicesAssembler command line arguments. These arguments are listed in "Arguments that Affect Deployment Descriptor Contents" on page 18-9.

This file also includes the configuration elements for Web services management: security, reliability, logging, and auditing. These configuration elements are described in "Understanding the Web Services Management Schema" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

<oracle-webservices> Element

The `<oracle-webservices>` element captures information local to the Oracle container for Web services. It has one attribute: `noNamespaceSchemaLocation`. This attribute is the "standard" way of telling the parser which schema the XML document should adhere to.

Table 18–2 describes the sub-elements contained in the `<oracle-webservices>` element.

Table 18–2 oracle-webservices Sub-elements

Sub-element	Description
<web-site>	Type `web-site` Default: the location where the service endpoint interface is installed (Optional) This sub-element provides a name for the host and the port name which will be substituted inside the updated WSDL port location. For example, you might need to enter this sub-element in the `oracle-webservices.xml` file if you are accessing the Web service by `port-component-link` resolution, or if you are publishing the WSDL to a location specified by `wsdl-publish-location`. This sub-element has the following attributes: ▪ `host`—the name for the host ▪ `port`—the name for the port If this sub-element is not used, the host and port values of the HTTP request used to get the WSDL will be substituted.

Table 18–2 (Cont.) oracle-webservices Sub-elements

Sub-element	Description
<context-root>	Type `string` Default: the EJB archive file name without the `.jar` extension This sub-element specifies the root context of the exposed Web service. It is required only for a version 2.1 EJB exposed as a Web service. If `context-root` is not specified, it defaults to the EJB archive file name without the `.jar` extension. For example, if the EJB archive file is named `foo-ejb.jar`, then the context root will be `/foo-ejb`. For Java-class Web services, the context root is specified inside `application.xml`. The *Oracle Containers for J2EE Configuration and Administration Guide* provides more information on the `<context-root>` element.
<webservice-description>	See "<webservice-description> Element".

<webservice-description> Element

This element extends the `<webservice-description>` element in the standard deployment descriptor, `webservices.xml`. The `name` attribute maps to the `name` element in `webservices.xml`. Table 18–3 describes the sub-elements contained in `<webservice-description>`.

Table 18–3 <webservice-description> Sub-elements

Sub-element	Description
<expose-wsdl>	Type `Boolean` Default: `true` This sub-element specifies whether the WSDL should be exposed.
<expose-testpage>	Type `Boolean` Default: `true` This sub-element specifies whether the test-page should be exposed.
<resolve-relative-imports>	Type `Boolean` Default: `false` This sub-element is used to specify whether you want to resolve from relative imports to absolute URLs.
<download-external-imports>	Type `Boolean` Default: `false` This sub-element specifies whether the relative imports should be downloaded and resolved to absolute URLs. Note: if `download-external-imports` is set to `true`, then `resolve-relative-imports` is automatically set to `true`.
<wsdl-file>	Type `wsdl-file` Default: n/a This sub-element is generated at deployment time and cannot be specified by an end-user. Its `final-location` attribute specifies the location of the final updated WSDL.

Table 18–3 (Cont.) <webservice-description> Sub-elements

Sub-element	Description
<wsdl-publish-location>	Type: `anyURI` Default: n/a (Optional) This element is used to specify the location where the final WSDL and its dependent files (imports) can be placed. The value should be of the form `file:/`*location*`/'`
<port-component>	See "<port-component> Element".

<port-component> Element

This `<port-component>` element is used as a reference to map to similar elements in the standard deployment descriptor `webservices.xml` with a `-name` appended to them. The elements contain information pertaining to a particular port. The `name` attribute of `<port-component>` maps to the `name` element in `webservices.xml`. Table 18–4 describes the sub-elements contained in the `<port-component>` tag.

Table 18–4 <port-component> Sub-elements

Sub-element	Description
<endpoint-address-uri>	Type: `string` Default: n/a This sub-element, needed only for an EJB 2.1 Web service, specifies the sub-context of the HTTP URL at which this EJB is exposed as a Web service. If none is provided, it defaults to the `port-component` name. Two transport-level elements are provided to secure this URI. For more information on these elements, see "<ejb-transport-security-constraint> Element" on page 18-16 and "<ejb-transport-login-config> Element" on page 18-17. For a Web module, (Web services derived from Java classes), this information is already present in the `web.xml` file and is not required.
<implementor>	Type: `implementor` Default: n/a This sub-element captures information about OC4J's proprietary Web services. This sub-element has a `param` attribute.
<max-request-size>	Type: `long` integer Default: -1 This sub-element enables you to configure a maximum size, in bytes, for a message passed to the Web service. If the Web service reads a message that passes this number of bytes, then the transmission will fail and the connection will close. If a non-positive value is assigned, then it is assumed there is no limit. The default, `-1` means unlimited. There is no limit as to the size.
<ejb-transport-security-constraint>	Defines transport-level security for a Web service based on EJBs. See "<ejb-transport-security-constraint> Element" on page 18-16.

Table 18–4 (Cont.) <port-component> Sub-elements

Sub-element	Description
<runtime>	Denotes the start of the Web services management information. For more information, see "Understanding the Web Services Management Schema" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
<use-dime-encoding>	Type: `Boolean` Default: `false` If set to true, any SOAP responses returned from this service that have attachments will be encoded in DIME. If false (default), any SOAP responses with attachments will be returned in MIME encoding. See "Working with DIME Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide* for more information on DIME-encoded attachments.
<jms-address>	Type: `jms-address` Default: n/a The address element used for providing JMS destination information. This is used when JMS transport is specified to send SOAP messages over JMS.
<rest-support>	Type: `Boolean` Default: `false` The rest element indicates whether this port supports REST-style `GET` and `POST` requests and responses.

Securing EJB-Based Web Services at the Transport Level

The `oracle-webservices.xml` deployment descriptor provides two elements that allow you to define transport-level security for Web services that are based on EJBs. These elements are described in the following sections. For more information on this topic, see also "Adding Transport-level Security for Web Services Based on EJBs" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.

- <ejb-transport-security-constraint> Element
- <ejb-transport-login-config> Element

<ejb-transport-security-constraint> Element

This element is used to associate transport-level security constraints for a version 2.1 EJB exposed as Web service. The URL of the EJB exposed as a Web service is indicated by the `<endpoint-address-uri>` element in the port component.

The sub-elements `<wsdl-url>` and `<soap-port>` are identifiers that let you choose whether the security constraints will apply to a WSDL URL or to a SOAP port. If `<wsdl-url>` and `<soap-port>` are both present or both absent in `<ejb-transport-security-constraint>` then the security constraints will apply to both the WSDL and the SOAP port. Table 18–5 describes the sub-elements of `<ejb-transport-security-constraint>`.

Table 18–5 <ejb-transport-security-constraint> Sub-elements

Sub-element	Description
<wsdl-url>	Type: (element identifier) Default: n/a If present, this sub-element specifies that the security constraints must apply only to the WSDL URL.
<soap-port>	Type: (element identifier) Default: n/a If present, this sub-element specifies that the security constraints must apply only to the SOAP port.
<role-name>	Type: `string` Default: n/a This sub-element identifies the name of a security role. The name must conform to the lexical rules for a token. The `role-name` used here must correspond to either: ■ the role name of one of the security role elements defined for this EJB application, or ■ the reserved role-name "`*`" that indicates all roles in the EJB application. If both "`*`" and role names are entered in this sub-element, the container interprets this as all roles. If no roles are defined, then no user is allowed access to the portion of the Web application described by the containing security constraint. The container matches role names in a case-sensitive manner.
<transport-guarantee>	Type: `transport-guarantee` Default: n/a This sub-element specifies constraints on the access to data transmitted between the client and server. This sub-element can have one of the following values: ■ `NONE`—the application does not require any transport guarantees. ■ `INTEGRAL`—the application requires that the data sent between the client and server must be sent in such a way that it cannot be changed in transit. ■ `CONFIDENTIAL`—the application requires that the data be transmitted in a fashion that prevents other entities from observing the contents of the transmission. In most cases, the presence of the `INTEGRAL` or `CONFIDENTIAL` flag will indicate that SSL must be used.

<ejb-transport-login-config> Element

The `<ejb-transport-login-config>` element is used to configure the transport-level authentication method and the realm name that should be used for this EJB application. The URL of the EJB application exposed as a Web service is indicated by the `<endpoint-address-uri>` element in the port component. Table 18–6 describes the sub-elements of `<ejb-transport-login-config>`.

Table 18–6 <ejb-transport-login-config> Sub-elements

Sub-element	Description
<auth-method>	Type: `auth-method` Default: `n/a` This sub-element is used to configure the authentication mechanism for an EJB application. As a prerequisite to gaining access to any Web resources which are protected by an authorization constraint, a user must have authenticated using the configured mechanism. Legal values for this sub-element are `BASIC`, `DIGEST`, `CLIENT-CERT`, or a vendor-specific single sign-on authentication scheme.
<realm-name>	Type: `string` Default: `n/a` This sub-element specifies the realm name to use in HTTP Basic authorization for an EJB exposed as Web service.

oracle-webservices.xml File Listing

Example 18–3 provides a listing of a sample `oracle-webservices.xml` deployment descriptor. Note that this sample file also includes the Web services management elements. These elements are described in the sections indicated in the file.

Example 18–3 Sample oracle-webservices.xml File

```
<?xml version="1.0" encoding="UTF-8"?>
<oracle-webservices xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:noNamespaceSchemaLocation="http://xmlns.oracle.com/oracleas/schema/oracle-webs
ervices-10_0.xsd"
   deployment-version="String" deployment-time="String" schema-major-version="10"
   schema-minor-version="0">
   <web-site host="String" port="String"/>
   <context-root>String</context-root>
   <webservice-description name="String">
      <expose-wsdl>true</expose-wsdl>
      <expose-testpage>true</expose-testpage>
      <resolve-relative-imports>false</resolve-relative-imports>
      <download-external-imports>false</download-external-imports>
      <port-component name="String">
         <endpoint-address-uri>String</endpoint-address-uri>
         <ejb-transport-security-constraint>
            <wsdl-url/>
            <soap-port/>
            <role-name>Manager</role-name>
            <role-name>Administrator</role-name>
            <transport-guarantee>NONE</transport-guarantee>
         </ejb-transport-security-constraint>
```

<!-- For a listing and description of elements that define transport-level security constraints for EJBs, see "<ejb-transport-security-constraint> Element" on page 18-16. -->

```
         <implementor type="database">
            <param name="String">String</param>
         </implementor>
         <runtime enabled="String">
            <owsm/>
```

<!-- For a description of the element for the Oracle Web Services Manager (<owsm>) see the *Oracle Web Services Manager User and Administrator Guide* -->

```
<security>
```

<!-- For a description and listing of security elements, see the *Oracle Application Server Web Services Security Guide*. -->

```
</security>
<reliability>
   <repository jndiLocation="..." name="..." type="..."/>
```

<!-- For a description and listing of port-level reliability elements, see "Port-Level Reliability Elements on the Server" in the *Oracle Application Server Advanced Web Services Developer's Guide*. -->

```
</reliability>
<logging/>
</runtime>
<operations>
   <operation name="String" input="String">
      <runtime>
         <security>
```

<!-- For a description and listing of security elements, see the *Oracle Application Server Web Services Security Guide*. -->

```
         </security>
         <reliability>
            <duplication-elimination-required/>
            <guaranteed-delivery-required/>
```

<!-- For a listing and description of operation-level reliability elements, see "Operation Level Reliability Elements on the Server" in the *Oracle Application Server Advanced Web Services Developer's Guide*. -->

```
         </reliability>
         <auditing request="false" response="false" fault="false"/>
```

<!-- For a listing and description of operation-level auditing elements, see "Server-Side Auditing Configuration Elements" in the *Oracle Application Server Advanced Web Services Developer's Guide*. -->

```
         <logging>
```

<!-- For a listing and description of operation-level logging elements, see "Operation Level Logging Elements on the Server" in the *Oracle Application Server Advanced Web Services Developer's Guide*. -->

```
         </logging>
      </runtime>
   </operation>
</operations>
</port-component>
</webservice-description>
<ejb-transport-login-config>
   <auth-method>BASIC</auth-method>
   <realm-name>sec-ejb</realm-name>
</ejb-transport-login-config>
```

<!-- For a listing and description of elements that define transport-level security for EJBs, see "<ejb-transport-login-config> Element" on page 18-17. -->

```
</oracle-webservices>
```

Limitations

See "Packaging and Deploying Web Services" on page C-9.

Additional Information

For more information on:

- assembling Web services from a WSDL, see Chapter 5, "Assembling a Web Service from a WSDL".
- assembling stateful Web services, see Chapter 6, "Assembling a Web Service with Java Classes".
- assembling Web services from EJBs, see Chapter 7, "Assembling a Web Service with EJBs".
- assembling Web services from a JMS queue or topic, see Chapter 8, "Assembling Web Services with JMS Destinations".
- assembling Web services from database resources, see Chapter 9, "Developing Database Web Services".
- assembling Web services with J2SE 5.0 Annotations, see Chapter 10, "Assembling Web Services with Annotations".
- building J2EE clients, see Chapter 13, "Assembling a J2EE Web Service Client".
- building J2SE clients, see Chapter 14, "Assembling a J2SE Web Service Client".
- using the WebServicesAssembler tool to assemble Web services, see Chapter 17, "Using WebServicesAssembler".
- using the JAX-RPC mapping file and its contents, see "JAX-RPC Mapping File Descriptor" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- the contents of `wsmgmt.xml` management policy file, see "Understanding the Web Services Management Schema" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- working with DIME attachments, see "Working with Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding transport-level security to Web services based on EJBs, see "Adding Transport-level Security to a Web Service" and "Accessing Web Services Secured on the Transport Level" in the *Oracle Application Server Web Services Security Guide*.
- the Oracle Web Services Manager tool, see the *Oracle Web Services Manager User and Administrator Guide*.
- using quality of service features in Web service clients, see "Managing Web Services" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding security to a Web service, see the *Oracle Application Server Web Services Security Guide*.
- adding reliability to a Web service, see "Ensuring Web Service Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
- adding an auditing and logging configuration to a Web service, see "Auditing and Logging Messages" in the *Oracle Application Server Advanced Web Services Developer's Guide*.

A

Web Service Client APIs and JARs

This appendix contains high-level descriptions of the Web services client API packages. It also identifies the JAR files that are required to run a Web service client.

This appendix contains these sections:

Web Services API Packages

Table A–1 lists the public Oracle APIs available in the current release of Oracle Application Server Web Services. The `provider` package can be used only in the OC4J container. The other APIs can be used in the container or in a Web services client. For more information on the APIs listed in this table, see the Oracle Technology Network: `http://www.oracle.com/technology/index.html`.

Table A–1 Client API Packages

Package Name	Description
oracle.webservices	Contains the Oracle-specific extension classes and interfaces that are common for all modules.
oracle.webservices.attachments	Contains classes and interfaces to support streaming attachments. For more information on using this package, see "Working with Message Attachments" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
oracle.webservices.databinding	Contains the `SOAPElementSerializer` interface which you can use for custom serialization. For more information on using the functionality provided by the `databinding` package, see "Custom Serialization of Java Value Types" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
oracle.webservices.provider	Contains the interfaces and classes needed to implement provider-based endpoints. For more information on using the `provider` package, see "Using Web Service Providers" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
oracle.webservices.reliability	Contains the interfaces and classes needed to implement reliable SOAP message exchange using WS-Reliability. For more information see "Dynamically Configuring Client Side Reliability" in the *Oracle Application Server Advanced Web Services Developer's Guide*.
oracle.webservices.security.callback	Provides classes to support Web Services security call back.

Table A–1 (Cont.) Client API Packages

Package Name	Description
oracle.webservices.soap	Contains the Oracle extension classes and interfaces to support SOAP 1.2. For more information on this API, see "OraSAAJ APIs" on page 4-11.
oracle.webservices.transport	Contains the classes and interfaces to support multiple transport bindings. "Writing Client Code to Support JMS Transport" in the *Oracle Application Server Advanced Web Services Developer's Guide* provides information on how classes in this package are used in JMS transport.
oracle.webservices.wsdl	Contains the Oracle-specific interface to support SOAP 1.2 operations in WSDL 1.1. For more information on this interface, see Appendix B, "Oracle Implementation of the WSDL 1.1 API".

Setting the Web Service Proxy Client Classpath

When you build a Web service client, you must use the correct classpath setting to run it. The following sections list the JAR files that can be included on the classpath. The tables in this section use the *OC4J_HOME* environment variable to specify the location where the Oracle Application Server or the standalone OC4J is installed.

Simplifying the Classpath with wsclient_extended.jar

To simplify your configuration of J2SE environments, OracleAS Web Services provides a `wsclient_extended.jar` file that contains all the classes necessary to compile and run a Web service client. This file can be listed on the classpath as an alternative to listing individual JARs.

The `wsclient_extended.jar` file contains these class files:

- class files in the individual JAR files listed in Table A–2
- OC4J Security-related class files in the JARs listed in Table A–3
- WS-Security-related class files in the JARs listed in Table A–4
- WS-Reliability-related class files in the JARs listed in Table A–5
- JMS transport-related class files in the JAR listed in Table A–6

You do not have to include any of these JAR files on the classpath if you run the client with the `wsclient_extended.jar` file.

The `wsclient_extended.jar` file is available as a separate download from the Oracle Technology network:

`http://download.oracle.com/otn/java/oc4j/1013/wsclient_extended.zip`

The file can also be installed from the OC4J companion CD. In this case, you will find it in the *ORACLE_HOME*`/webservices/lib` directory.

Classpath Components for Clients using a Client-Side Proxy

Table A–2 lists the JAR files that can be included in the classpath for a J2SE Web services client.

Note: The `wsclient.jar` listed in this table contains only the core Web service client classes. At compilation and runtime, the Web service client requires many other classes such as those for the XML parser, the WSDL parser, and quality of service (QOS). All of these required classes are packaged into `wsclient_extended.jar` to simplify classpath set up.

Note: Note that not all JAR files are required in all cases.

Table A–2 Classpath Components for a Client Using a Client-Side Proxy

Component JAR	Description
ORACLE_HOME/diagnostics/lib/ojdl.jar and *ORACLE_HOME*/diagnostics/lib/ojdl2.jar	ODL implements APIs to be used by Oracle products to emit error diagnostics and a LogLoader tool that collects error diagnostic logs for analysis.
ORACLE_HOME/j2ee/home/oc4j-api.jar	Contains the public OC4J APIs.
ORACLE_HOME/j2ee/home/oc4jclient.jar	Contains the files needed by the OC4J client.
ORACLE_HOME/j2ee/home/lib/activation.jar	Usually, this component is available in the JRE. If it is not, then include it in the classpath. This JAR is needed only for processing attachments.
ORACLE_HOME/j2ee/home/lib/adminclient.jar	Contains J2EE APIs for platform management and application deployment.
OC4J_HOME/j2ee/home/lib/ejb.jar	Contains class files for Enterprise Java Beans.
OC4J_HOME/j2ee/home/lib/http_client.jar	Contains the Oracle HTTP client transport implementation.
OC4J_HOME/j2ee/home/lib/javax77.jar	Contains the J2EE management specification (JSR 77) APIs.
OC4J_HOME/j2ee/home/lib/jax-qname-namespace.jar	Contains the QName definition.
OC4J_HOME/j2ee/home/lib/jmxri.xml	Contains the JMX APIs.
OC4J_HOME/j2ee/home/lib/jmx_remote_api.jar	Contains the JMX Remote APIs.
OC4J_HOME/j2ee/home/lib/mail.jar	Contains the JavaMail API and all service providers. Usually, this component is available in the JRE. If it is not, then include it in the classpath.
OC4J_HOME/j2ee/home/lib/oc4j-schemas.jar	Contains the OracleAS Web Services public schemas.
OC4J_HOME/j2ee/home/lib/servlet.jar	Contains the servlet implementation.
OC4J_HOME/lib/dms.jar	Contains the DMS implementation for Oracle Diagnostics and Monitoring.
OC4J_HOME/lib/xml.jar	Contains the JAXB implementation.
OC4J_HOME/lib/xmlparserv2.jar	Contains the Oracle XML parser JAR.
OC4J_HOME/lib/xsu12.jar	Contains the Oracle XDK SQL utility.
OC4J_HOME/webservices/lib/commons-logging.jar	Contains a logging library package.

Table A–2 (Cont.) Classpath Components for a Client Using a Client-Side Proxy

Component JAR	Description
OC4J_HOME/webservices/lib/jaxrpc-api.jar	Contains the JAX-RPC API, including `javax.xml.rpc` and `java.xml.namespace`.
OC4J_HOME/webservices/lib/orasaaj.jar	Contains the Oracle implementation of the SAAJ API.
OC4J_HOME/webservices/lib/orawsdl.jar	Contains the Oracle implementation (OraWSDL) of the Java APIs for the WSDL specification (JSR 110).
OC4J_HOME/webservices/lib/relaxngDatatype.jar	Contains the RELAX NG data type library shared by several JAX* technologies.
OC4J_HOME/webservices/lib/saaj-api.jar	Contains the SAAJ API 1.1 for processing messages with attachments.
OC4J_HOME/webservices/lib/wsclient.jar	Contains the classes that are required by the Web service client runtime.
OC4J_HOME/webservices/lib/wsdl-api.jar	Contains the Java APIs for WSDL (JSR 110).
OC4J_HOME/webservices/lib/wsif.jar	Contains the Oracle WSIF implementation.
OC4J_HOME/webservices/lib/xsdlib.jar	Contains the XML Schema type library shared by several JAX* technologies.

OC4J Security-Related Client JAR Files

Table A–3 lists the JAR files that must be included in the classpath when a J2SE Web service client supports OC4J Security. The `wsclient_extended.jar` file contains the OC4J Security-related class files in the JARs listed in this table. There is no need to include these JARs if you run the client with the `wsclient_extended.jar` file.

Table A–3 OC4J Security CLASSPATH Components for a Client Using a Client-Side Proxy

Component Name	Description
OC4J_HOME/j2ee/home/lib/jta.jar	Contains JTA (Java Transaction API) Specification APIs.
OC4J_HOME/j2ee/home/lib/jaas.jar	Contains the Java Authorization and Authentication Specification (JAAS) APIs.
OC4J_HOME/j2ee/home/lib/jazn.jar	Contains the JAZN (Oracle JAAS provider) implementation.
OC4J_HOME/j2ee/home/lib/jazncore.jar	Contains the JAZN (Oracle JAAS provider) implementation.

WS-Security-Related Client JAR Files

Table A–4 lists the JAR files that must be included in the classpath when a J2SE Web service client supports WS-Security. The `wsclient_extended.jar` file contains the WS-Security-related class files in the JARs listed in this table. There is no need to include these JARs if you run the client with the `wsclient_extended.jar` file.

Table A–4 WS-Security CLASSPATH Components for a Client Using a Client-Side Proxy

Component Name	Description
OC4J_HOME/jlib/javax-ssl-1_1.jar	Contains transport-level security support.
OC4J_HOME/jlib/jaxen.jar	Contains the classes that define Jaxen—a Java XPath Engine capable of evaluating XPath expressions across multiple modes (such as dom4j, JDOM, and so on).
OC4J_HOME/jlib/ojpse.jar	Contains the core encryption implementation.

Table A–4 (Cont.) WS-Security CLASSPATH Components for a Client Using a Client-Side Proxy

Component Name	Description
OC4J_HOME/jlib/oraclepki.jar	Contains the Oracle orapki keytool utility.
OC4J_HOME/jlib/osdt_core.jar	Contains the Oracle Security Developer's Toolkit (OSDT) APIs.
OC4J_HOME/jlib/osdt_cert.jar	Contains the Oracle Security Developer's Toolkit cryptography APIs.
OC4J_HOME/jlib/osdt_saml.jar	Contains Oracle Security Developer's Toolkit Security Assertion Markup Language (SAML) APIs.
OC4J_HOME/jlib/osdt_wss.jar	Contains Oracle Security Developer's Toolkit Web services security (WS-Security) APIs.
OC4J_HOME/jlib/osdt_xmlsec.jar	Contains Oracle Security Developer's Toolkit XML signing and encryption APIs.
OC4J_HOME/webservices/lib/wssecurity.jar	Contains the WS-Security APIs.

Reliability-Related Client JAR File

Table A–5 lists the JAR files that must be included in the classpath when a J2SE Web service client supports WS-Reliability. The `wsclient_extended.jar` file contains the WS-Reliability-related class files in the JAR listed in this table. There is no need to include this JAR if you run the client with the `wsclient_extended.jar` file.

Table A–5 Reliability CLASSPATH Components for a Client Using a Client-Side Proxy

Component Name	Description
OC4J_HOME/webservices/lib/orawsrm.jar	Contains Web service Reliability (WS-Reliability) APIs and their implementation.

JMS Transport-Related Client JAR File

Table A–6 lists the JAR file that must be included in the classpath when a J2SE Web service client supports JMS as a transport mechanism. The `wsclient_extended.jar` file contains the JMS transport-related class files in the JAR listed in this table. There is no need to include this JAR if you run the client with the `wsclient_extended.jar` file.

Table A–6 CLASSPATH Components for a Client Using JMS as a Transport Mechanism

Component Name	Description
J2EE_HOME/j2ee/home/lib/jms.jar	Contains the JMS APIs.

Database Web Services-Related Client JAR Files

The JAR files listed in Table A–7 must be needed in the classpath when a J2SE Web service client wants to invoke a service that uses parameters or returns in SQL/XML format, or are of type `WebRowSet`. The client must also include these libraries when invoking a database Web service using a native WSIF binding.

> **Note:** The class files in the JARs listed in this table are **not** included in the `wsclient_extended.jar` file. If the client needs the functionality provided by these files, then they must be listed explicitly on the classpath.

Table A–7 Database-Related CLASSPATH Components for a Client Using a Client-Side Proxy

Component Name	Description
ORACLE_HOME/rdbms/jlib/aqapi.jar	Contains the Oracle Advanced Queueing API
ORACLE_HOME/jdbc/lib/ocrs12.jar	Contains the Oracle WebRowSet implementation
ORACLE_HOME/jdbc/lib/ojdbc14dms.jar	Contains the Oracle JDBC driver
OC4J_HOME/lib/xsu12.jar	Contains the Oracle SQL/XML format implementation

Sample Classpath Commands

Example A–1 provides sample Windows platform `set CLASSPATH` commands for all of the Oracle Application Server Web Services client JAR files. The classpath on the UNIX platform would be set in a similar manner.

Example A–1 set CLASSPATH Commands for the Windows Platform

```
set CLASSPATH=%ORACLE_HOME%\j2ee\home\oc4jclient.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\adminclient.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\ejb.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\mail.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\activation.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jms.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\http_client.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jaas.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jazn.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\javax77.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jax-qname-namespace.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jta.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jazncore.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\servlet.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jmx_remote_api.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\jmxri.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\j2ee\home\lib\oc4j-schemas.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\lib\xmlparserv2.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\xdk\lib\xml.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\orawsrm.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\xsdlib.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\relaxngDatatype.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\lib\dms.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\commons-logging.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\jaxrpc-api.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\wsclient.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\wsdl-api.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\wsif.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\wssecurity.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\saaj-api.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\orasaaj.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\webservices\lib\orawsdl.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\osdt_wss.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\osdt_xmlsec.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\ojpse.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\osdt_saml.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\oraclepki.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\osdt_core.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\osdt_cert.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\jaxen.jar;%CLASSPATH%
set CLASSPATH=%ORACLE_HOME%\jlib\javax-ssl-1_1.jar;%CLASSPATH%
```

B

Oracle Implementation of the WSDL 1.1 API

This appendix describes the Oracle implementation of the Java APIs for WSDL version 1.1 (OraWSDL). These APIs allow you to read, modify, write, create, and re-organize WSDL documents in memory.

The key Java API for WSDL is the `javax.wsdl.factory.WSDLFactory` class. This abstract class enables applications to obtain a WSDL factory capable of producing new definitions, new `WSDLReaders`, and new `WSDLWriters`.

For more information on the Java APIs for WSDL version 1.1, see:

`http://www.jcp.org/en/jsr/detail?id=110`

Understanding the OraWSDL APIs

The OracleAS Web Services implementation of the `javax.wsdl.factory.WSDLFactory` class is `oracle.webservices.wsdl.WSDLFactoryImpl`. Use this class to create new WSDL factory instances. As the abstract `WSDLFactory` class requires, OracleAS Web Services provides extensions to support XMLSchema, SOAP, HTTP, and MIME.

The `WSDL_READ_TIMEOUT` property specifies the maximum amount of time, in seconds, that the `WSDLReader` implementation waits to receive a response to a request for a remote WSDL definition. The location of the WSDL must be specified by an HTTP or HTTPS URL. No other protocols are supported.

Here are a few examples of where you can use the functionality provided by the `WSDLFactory` class.

- writing a WSDL manipulation tool
- programmatically analyzing a WSDL
- writing WSIF provider

Example B–1 provides sample code that uses the Java APIs for WSDL to get and manipulate a WSDL file. The samples illustrate the following tasks.

- getting a WSDL factory instance
- creating a WSDL file reader and registering the standard extensions
- setting a timeout for reading the WSDL definition
- reading a WSDL file
- getting information from a WSDL file

In the code lines that get a WSDL factory, note that the `WSDLFactory.newInstance` method uses the Oracle `WSDLFactoryImpl` class to create the WSDL factory instance.

Example B–1 Using the Java APIs for WSDL to Manipulate a WSDL

```
   ...
//--Get the WSDLFactory. You must specifiy Oracle's implementation class name
       WSDLFactory wsdlFactory = WSDLFactory.newInstance("oracle.webservices.wsdl.
WSDLFactoryImpl");
   ...
//--Create a reader and register the standard extensions
       WSDLReader wsdlReader = wsdlFactory.newWSDLReader();
       ExtensionRegistry extensionRegistry = wsdlFactory.
newPopulatedExtensionRegistry();
       wsdlReader.setExtensionRegistry(extensionRegistry);
   ...
 //--Set a sixty-second timeout for reading the WSDL definition
        System.setProperty(oracle.webservices.wsdl.WSDLFactoryImpl.WSDL_READ_
TIMEOUT, "60" );
   ...
//--Read a WSDL file, including any imports
       Definition def = wsdlReader.readWSDL("http://some.com/someservice?WSDL");
   ...
//--You can now explore the WSDL definition, for example,
       Map services = def.getServices();
       String targetNamespace = def.getTargetNamespace();
   ...
```

The code in Example B–2 demonstrates how you can get the WSDL by using methods in the `javax.xml.rpc.server.ServletEndpointContext` and `javax.servlet.ServletContext` classes. The WSDL is obtained and stored as an `InputStream`. This technique works not only for the WSDL, but for any resource.

The `// code to handle the input stream` section indicates where you can insert OraWSDL API code similar to the samples in Example B–1 to get and manipulate the WSDL file.

Example B–2 Getting the WSDL as a Resource

```
public class HelloImpl  implements javax.xml.rpc.server.ServiceLifecycle {
    // default constructor
    public HelloImpl() {
}
    public init(Object context){
        javax.xml.rpc.server.ServletEndpointContext ctx = (javax.xml.rpc.server.
ServletEndpointContext) context;
        javax.servlet.ServletContext servletContext= ctx.getServletContext();
        //we can read any other resource the same way.
        java.io.InputStream wsdlDocument = servletContext.
getResourceAsStream("/WEB-INF/wsdl/MyWsdl.wsdl")) ;

       // code to handle the input stream
      ...
    }

   //empty implementation
    public void destroy() {}

    // sayHello method
    public String sayHello(String name) {
        return ("Hello " + name + "!");
    }
}
```

C

Troubleshooting

This appendix provides solutions to possible problems that may occur when working with Oracle Application Server Web Services. The section titles in this appendix correspond to chapter titles in the *Oracle Application Server Web Services Developer's Guide* and the *Oracle Application Server Advanced Web Services Developer's Guide*.

OracleAS Web Services Messages

Cannot Serialize or Deserialize Array-Valued Elements to Collection Types

If you use a Java Collection type (such as `java.util.Map`, `java.util.Collection`, or a subclass of these) as a parameter or return type in your RPC-encoded Web service, then the runtime cannot properly serialize or deserialize array-valued elements to these collection parameters.

To ensure that serializers and deserializers are registered for Java array types when using the RPC-encoded message format, create a Java value type to represent each Java array.

1. Create a Java value type for each Java array type that you want to use.

   > **Note:** Ensure that the Java value type does not contain the word "Array" in its name. "Array" is a recognized pattern.

   The following example represents the contents of the `demo/StringAry.java` file. A wrapper class, `StringAry`, represents the Java `String[]` array. Note that the name of the class uses the suffix "Ary".

   ```
   package demo;
   public class StringAry
   { public StringAry() { }
     public String[] getValue() { return m_value; }
     public void setValue(String[] value) { m_value=value; }
     private String[] m_value;
   }
   ```

2. Ensure that the proper serializers and deserializers are registered for all of your value types.

   To do this, use the `valueType` argument when you assemble the Web service. In the following example, the argument specifies the `demo/StringAry.java` file created in Step 1.

   ```
   java wsa.jar -assemble -valueType demo.StringAry ...
   ```

3. Use the value types you defined for setting and retrieving array-valued elements in your collection type parameter.

   For example, assume that you have the following class definition.

```
package demo;
public class Service extends java.rmi.Remote
{ java.util.Map getMap(String input)throws java.rmi.RemoteException
  { ... }
}
```

   You can write the following code to return a `String[]` value as one of the elements in the map.

```
HashMap map = new HashMap();
String[] str_array = new String[]{"a","b","c"};
StringAry sa = new StringAry();
sa.setValue(str_array);
map.put("myArray", sa);
return map;
```

Errors Occur When Publishing a Web Service that Uses Multi-Dimensional Arrays

An error occurs when attempting to publish a Web service that uses multidimensional arrays. For example, an error can be returned when you attempt to publish a Java class that contains a method which takes a multidimensional array as an input or as a return argument.

There are two possible solutions to this problem:

- Create a Java Bean for each dimension of the array
- Use RPC-encoded message format to publish the Web service

Creating a Java Bean for each Dimensional of the Array: You can wrap each dimension of the array into a Java value type and work around the limitation.

> **Note:** Ensure that the Java value type does not contain the word "Array" in its name. "Array" is a recognized pattern.

In the following example, the `public static class StringAry` wraps the inner array of strings. The `public StringAry[]` represents an array of the inner array. That is, it contains an array of `String` Java value types. Note that the code sample uses the suffix "Ary".

```
package demo;
public interface SampleItf extends java.rmi.Remote

 // wrap the inner array as a Java value type
{ public static class StringAry
  { public StringAry() { }
    public String[] getValue() { return m_value; }
    public void setValue(String[] value) { m_value=value; }
    private String[] m_value;
  }

  // create an  array of the inner array elements
  public StringAry[] echoString2(StringAry[] input)
        throws java.rmi.RemoteException;
}
```

The `Service` class illustrates how you can then publish the `StringAry[]` array of `String` Java value types.

```
package demo;
public class Sample implements java.rmi.Remote, SampleItf
{ public SampleItf.StringAry[] echoString2(SampleItf.StringAry[] input)
         throws java.rmi.RemoteException
  { return input; }
}
```

Using RPC-Encoded Style to Publish a Web Service: You can use the RPC-encoded style to publish a Web service that uses multidimensional arrays. For example:

```
package demo;
public interface SampleItf extends java.rmi.Remote
{ public String[][] echoString2(String[][] input)
         throws java.rmi.RemoteException;
}


package demo;
public class Sample implements java.rmi.Remote, SampleItf
{ public String[][] echoString2(String[][] input)
         throws java.rmi.RemoteException
  { return input; }
}
```

Restrictions on RPC-Encoded Format and Data Binding

OracleAS Web Services does not support the combination of RPC-encoded message formats and `databinding=false`. This combination is not considered a "best practice" within the industry.

Document-Encoded Message Format is not Supported by OracleAS Web Services

Even though the combination of `style="document"` and `use="encoded"` is valid according to the SOAP specification, it is not supported by any of the major Web Services platforms, including OracleAS Web Services.

Document-Literal Bare Message Format is Limited to One Input Part

OracleAS Web Services supports only one part as input in the bare case. All other input parameters must be mapped into SOAP header parts.

Serialization of BigDecimal Values May Introduce Rounding Errors

There are several constructors available for `java.Math.BigDecimal`. The constructors can take the following types of input.

- a double-precision floating point
- an integer and a scale factor
- a String representation of a decimal number

You should be careful when you use the `BigDecimal(double)` constructor. It can allow rounding errors to enter into your calculations. Instead, use the `integer` or `String`-based constructors.

For example, consider the following statements which take the value 123.45.

```
...
double d = 1234.45;
```

```
System.out.println(d);
System.out.println(new BigDecimal(d));
...
```

These statements produce the following output. The second value might not be the value you expected.

```
1234.45
1234.450000000000045474735088646411895751953125
```

Assembling Web Services from a WSDL

Restrictions on Using Document Literal Message Formats

If you attempt to assemble a Web service top down that uses a document-literal message format, WebServicesAssembler will return a warning if it detects two or more operations in the WSDL that use the same input message. This is because the OC4J runtime will not be able to distinguish which method is being invoked.

For example, the following WSDL fragment will cause WebServicesAssembler to return a warning. The fragment defines the `addRelationship` and `addRelationship3` operations. Each of these operations use the `addRelationshipRequest` input message.

```
...
<operation name="addRelationship">
     <input name="addRelationship1Request"
message="tns:addRelationship1Request"/>
            <output name="addRelationship1Response"
message="tns:addRelationship1Response"/>
        </operation>
         <operation name="addRelationship3">
            <input name="addRelationship1Request"
message="tns:addRelationship1Request"/>
            <output name="addRelationship1Response"
message="tns:addRelationship1Response"/>
        </operation>
...
```

If you were to invoke the `addRelationship` operation from your client, then depending on the order in which the operations appear in your implementation class, either `addRelationship` or `addRelationship3` would be invoked.

Assembling Web Services from Java Classes

Limitations on Stateful Web Services

The support that OracleAS Web Services offers for stateful Web services is limited to services based on Java classes. These services contain Oracle-proprietary extensions and you should not consider them to be interoperable unless the service provider makes scopes with the same semantics available.

The support that OracleAS Web Services offers for stateful Web services is HTTP-based. Stateful Web services will work only for SOAP/HTTP endpoints and will not work for SOAP/JMS endpoints.

Assembling Web Services from Java Classes—Differences Between Releases 10.1.3 and 10.1.2

Note the following differences between Oracle Web Services release 10.1.2 (and earlier) and release 10.1.3.

- In release 10.1.2 there was no requirement to extend `RemoteInterface` or for methods to throw `RemoteException`. This is now required in release 10.1.3.
- In release 10.1.2 it was possible to publish a class by itself without providing an interface. In release 10.1.3 you must provide an interface to publish a class.

Assembling Web Services From EJBs

Setting the Transaction Demarcation for EJBs

An EJB exposed as a Web service should not have `TX_REQUIRED` or `TX_MANDATORY` set as its transaction demarcation.

Assembling Web Services with JMS Destinations

Supported Types for Message Payloads

For JMS endpoint Web services, OracleAS Web Services supports only instances of `java.lang.String` or `javax.xml.soap.SOAPElement` as the payload of JMS messages.

JMS Properties in the SOAP Message Header

Only a limited number of JMS properties can be transmitted by the SOAP header. If the value of the `genJmsPropertyHeader` argument is `true` (default), then the following JMS properties can be transmitted by the SOAP header.

- message-ID
- correlation-ID
- the reply-to-destination, including its name, type, and factory

Developing Web Services From Database Resources

Datatype Restrictions

- Streams are not supported in Oracle Streams AQ Web services.
- SQL Type `SYS.ANYDATA` is not supported in PL/SQL Web services.
- `REF CURSOR` as a parameter is not supported in PL/SQL Web services.
- `REF CURSOR` returned as Oracle `WebRowSet` and `XDB RowSet` does not support complex types in the result.
- Due to a limitation in JDBC, PL/SQL stored procedures do not support the following SQL types as `OUT` or `INOUT` parameters.
  - `char` types, including `char`, `character`, and `nchar`
  - `long` types including `long` and `long raw`

Differences Between Database Web Services for 10.1.3 and Earlier Releases

A Web service client written for a database Web service generated under release 9.0.4 or 10.1.2, will fail if you try to use it against a database Web service generated bottom up under release 10.1.3. This will be true even if the PL/SQL structures have remained the same.

One of the reasons for this is that the SQL collection type was mapped into a complex type with a single array property in releases 9.0.4 and 10.1.2. In release 10.1.3, it is mapped directly into array instead.

If you regenerate the Web service client, you will have to rewrite the client code. This is because the regenerated code will now be employing an `array[]` instead of a `BeanWrappingArray`.

Assembling Web Services with Annotations

Web Service Metadata Features that are Not Supported

There are parts of the Web Services Metadata for the Java Platform specification that OracleAS Web Services does not support. For example, OracleAS Web Services does not support the "Start With WSDL" or "Start With WSDL and Java" modes defined in sections 2.2.2 and 2.2.3 of the "Java Architecture for XML Binding" (JAXB) specification. OracleAS Web Services supports only the "Start With Java" mode.

If you use the `assemble` or the `genWsdl` WebServicesAssembler commands to generate a WSDL to use with J2SE 5.0 Web Service annotations, you must specify them differently than if you were using them to process files that do not contain annotations. See "assemble" on page 17-7 and "genWsdl" on page 17-26 for more information on using these commands to generate WSDLs for use with J2SE 5.0 Web Service annotations.

Assembling REST Web Services

Restrictions on REST Web Services Support

The following list describes the limitations in OracleAS Web Services support for REST Web Services.

- REST support is available only for Web service applications with literal operations (both request and response should be literal).
- HTTP GET is supported only for Web service operations without (required) complex parameters.
- Some browsers limit the size of the HTTP GET URL. Try to keep the size of the URL small by using a limited number of parameters and short parameter values.
- REST Web services send only simple XML messages. You cannot send messages with attachments.
- Many management features, such as security and reliability, are not available with REST Web services. This is because SOAP headers, which are typically used to carry this information, cannot be used with REST invocations of services.
- REST invocations cannot be made from generated Stubs or DII clients. Invocations from those clients will be made in SOAP.
- There is no REST support for the Provider framework.
- Operation names in REST cannot contain multibyte characters.

- REST services cannot be managed through Application Server Control.

Testing Web Service Deployment

The Web Service Home Page has the following limitations:

- The Web Service Home Page offers only basic support for WS-Security. The editors can enter only a username and password into the SOAP envelope. To enter any other complex or advanced WS-Security features, such as encryption and signing, in the SOAP request, you must edit the request directly in the Invocation Page.
- The Web Service Home Page does not allow you to upload attachments.
- You cannot invoke WSIF services using the test page.
- WSDL files that contain proprietary extensions may not work properly in the Web Service Home Page. For example, services that use JMS as a transport cannot be tested by using the Home Page.

Assembling a J2EE Web Service Client

Client Applications and Thread Usage

If the client application creates its own threads for its processing (for example, if it enables an asynchronous call using a separate thread), the application server must be started with the `-userThreads` option.

```
java -jar oc4j.jar -userThreads
```

The `-userThreads` option enables context lookup and class loading support from user-created threads.

Understanding JAX-RPC Handlers

WebServicesAssembler provides Ant tasks that let you configure JAX-RPC message handlers. Handlers cannot be configured by using the WebServicesAssembler command line.

Processing SOAP Headers

Strong Typing and the ServiceLifecycle Interface

Although the `ServiceLifecycle` interface enables you to access SOAP header blocks that may not have been declared in the WSDL file, the blocks are not strongly typed. You may also need to know the XML structure of a SOAP header in order to process it. For strong typing of SOAP header blocks, make sure that the `mapHeadersToParameters` argument for WebServicesAssembler is set to `true` (`true` is the default value). This is only possible if the SOAP header has been declared in the WSDL file and the type of the SOAP header is a supported JAX-RPC type.

Using WebServicesAssembler

Long file names cause deployment to fail

If the combined length of the generated file and directory names passes a certain size limit, then deployment will fail and throw an error. This size limit varies for different

operating systems. For example, on the Windows operating system, the size limit is 255 characters

The length of the names is controlled by WebServicesAssembler and the deployment code. WebServicesAssembler generates file names based on the method name in the Java class or the operation name in the WSDL. The deployment code creates directories for code generation based on the names of the EAR and the WAR files.

To avoid the generation of file and directory names that are too long, limit the number of characters in the following names to a reasonable length.

- method names in Java classes
- operation names in the WSDL
- directory name for the location of the OC4J installation
- file name for a WAR file
- file name for a EAR file

You can also avoid this problem by upgrading to a more recent version of the J2SE 5.0 JDK (jdk-1_5_0_06 or later).

Getting More Information on WebServicesAssembler Errors

You can get detailed diagnostic information on errors returned by WebServicesAssembler by including the `debug` argument in the command line or Ant task. For more information on this argument, see "debug" on page 17-38.

WebServicesAssembler Cannot Compile Files

If WebServicesAssembler cannot compile files successfully, it will return the error:

```
java? java.io.IOException: CreateProcess: javac -encoding UTF-8 -classpath
```

The `javac` compiler must be available so that WebServicesAssembler can compile your Java files. Make sure that *`JAVA_HOME`*`/bin` is in your path.

WebServicesAssembler Cannot Find Required Classes

You may need to use some classes that are common to all J2EE 1.4 applications. All standard J2EE 1.4 classes and Oracle database classes are included automatically. When using Ant tasks, WebServicesAssembler must search for the JARs that contain these classes.

A WebServicesAssembler Ant task tries to load these extra classes by searching for `wsa.jar`. The task searches for the following Ant properties or environment variables in the following order. If the task does not find `wsa.jar`, or if a property is not defined, it searches the next property.

1. `oc4j.home`—an Ant property that specifies the root installation directory for OC4J. This property can be used instead of an environment variable.
2. `OC4J_HOME`—an environment variable that specifies the root installation directory for OC4J.
3. `oracle.home`—an Ant property that specifies the root installation directory for Oracle products. This property can be used instead of an environment variable.
4. `ORACLE_HOME`—an environment variable that specifies the root installation directory for Oracle products.

When the Ant task finds `wsa.jar`, it loads all of the classes listed in its manifest file, relative to the location of `wsa.jar`.

Packaging and Deploying Web Services

Packaging for J2EE Clients

The current tool set cannot package J2EE Web service clients. You must package the client manually. "Packaging a J2EE Client" on page 13-16 provides more information on how to package a J2EE Web service client.

Getting the Correct Endpoint Address when the WSDL Has More than One HTTP Port

If a you want to enter values for the `<web-site>` or `<wsdl-publish-location>` elements in `oracle-webservices.xml`, then the returned WSDL may not have the correct endpoint addresses if the WSDL has more than one HTTP port.

The WebServicesAssembler tool does not insert the `<web-site>` or `<wsdl-publish-location>` elements into the `oracle-webservices.xml` file that it creates. You must insert these elements manually.

Ensuring Interoperable Web Services

Leading Underscores in WebServicesAssembler Generated Names

The default behavior of the WebServicesAssembler tool is to generate namespaces from the Java package name. If the Java package name begins with a leading underscore ("_"), then the generated namespace URI will contain an underscore. Some versions of the .NET WSDL tool may not be able to consume these namespaces, even though the generated namespace is valid.

To work around this .NET issue, use the WebServicesAssembler arguments `targetNamespace` and/or `mappingFileName` to avoid the default package-derived namespace.

Working with Message Attachments

Adding Faults with swaRef Attachments to a Web Service

In OracleAS Web Services, you can add only `swaRef` MIME type attachments to SOAP fault messages. It does not support the adding of `SWA` type attachments.

Faults with attachments can be added to a Web service only when you are assembling it from a WSDL (top down). They cannot be added when assembling a Web service bottom up.

Supported Message Formats for Attachments

Only RPC-literal and document-literal Web services are supported by the WS-I Attachments Profile 1.0. Thus, only those types of services can use `swaRef` MIME type.

WebServicesAssembler will not be able to assemble a Web service that can pass `swaRef` MIME attachments if you specify an RPC-encoded message format. To assemble the service, you must select a different format.

Managing Web Services

Limitations on Application Server Control

Application Server Control cannot modify everything that can be expressed in the `wsmgmt.xml` file. For example, it cannot be used to change parts of the reliability configuration.

Ensuring Web Service Reliability

Reliability Limitations for OracleAS Web Services

- The reliability process on the client lives only as long as the client process. If the client process becomes permanently unavailable, then any messages that needed to be retried will be ignored.
- Asynchronous polling capabilities can be enabled only at the port level and only by using a configuration.

Auditing and Logging Messages

Limitations on xpath Queries

An `xpath` query must return a primitive type. This means that the query must return the context of text nodes or attribute values.

The primitive type that the `xpath` query returns should have a small number of characters. For example, it should not exceed 120 characters.

Custom Serialization of Java Value Types

This section describes limitations on the custom serialization of non-standard data types.

Literal Use

This release supports only literal as the `use` part of the message format. This includes RPC-literal and document-literal. RPC-encoded is not supported in this release.

Object Graph

Because RPC-encoded is not supported in this release, the initial support of serialization and deserialization does not allow object graph marshalling using `href`. If a Java Object has multiple references either in the parameters of a request or in the return value of a response, then serialization and deserialization might not preserve the object graph.

WSDL- and Service-Level Configuration

`SoapElementSerializer` is configured for each Service or for each WSDL. For example, a `SoapElementSerializer` implementation representing the mapping of `dateTime` to `oracle.sql.DATE` can be configured to replace the default mapping of `dateTime` to `java.util.Calendar`. Under this configuration, every instance of the mapping is replaced. Configuration for each operation or message level is not supported in this release.

Sub Tree Serialization

Each custom serializer gets the full XML sub-tree, and performs the serialization and deserialization of the entire XML element object model. For example, assume you have two custom serializers developed and configured for two top-level `complexTypes`, `TypeA` and `TypeB`. `TypeA` has a sub-element of `TypeB`. Even though a custom serializer has been configured for `TypeB`, this custom serializer cannot be automatically invoked by the OC4J runtime when the sub-element of `TypeB` is serialized inside the custom serializer for `TypeA`. The custom serializer of `TypeA` must handle the sub-element of `TypeB` by itself. The custom serializer of `TypeA` can, in turn, call the custom serializer of `TypeB`, but it is up to the implementation strategy.

Document-Literal Wrapper

Assume that a a custom serializer is used to handle a global `complexType` that is referred by a global element to define the single part of a document-literal operation. If you use the `unwrapParameters` argument to unwrap the return type and response type, it will be ignored for the operation(s) that use the global element as the body part of the input message.

Using JMS as a Web Service Transport

Interoperability of Messages when using JMS as a Transport Mechanism

The WSDL extensions that enable JMS as a transport mechanism are Oracle-proprietary. The messages produced by the Web service may not be interoperable with applications or services provided by other vendors.

Retrieving Client Responses from JMS Web Service Transport

If the client process becomes unavailable without receiving its response and later returns, there is no facility provided for it to retrieve its old responses from the queue.

Using the Web Service Invocation Framework

This section describes limitations in the OracleAS Web Services support for the Web Services Invocation Framework (WSIF).

- Database WSIF can pass only the data source, not the JDBC connection, to the provider for database access.
- Database WSIF is stateless. Each operation obtains a JDBC connection when it begins and closes it when it ends. Autocommit is always on for the JDBC connection. It is recommended that you use connection pooling when setting up data sources to reduce database overhead.
- Oracle's Application Server Control Web Services Management and Monitoring can only directly monitor SOAP services; it cannot monitor any service interactions that utilize WSIF bindings, such as Java, EJB, or database WSIF bindings. By bypassing the SOAP protocol entirely, you are also bypassing the management infrastructure for Web services provided by Oracle Application Server Control.

Using Dynamic Invocation Interface to Invoke Web Services

To invoke a Web service by using the Dynamic Invocation Interface (DII) requires a number of steps. At each step, you typically have to make some choices. The examples at the end of this section display choices made at each of the steps.

Using DII to invoke a Web Service consists of the following general steps:

1. Create the call object.
2. Register parameters.
3. Invoke the Web service.

You can create the call object either with or without a WSDL. If you do not have a WSDL, or decide not to use the WSDL for creating the call dynamically, then follow the steps under "Basic Calls". If you do have a WSDL to construct the call, then follow the instructions under "Configured Calls".

Basic Calls

For a basic call, the call object is created dynamically without a WSDL. The following steps provide more information on how to construct a basic call.

1. You are constructing a call object dynamically, without a WSDL. For examples, see:
   - Example C–1, "Basic Call with parameter registration and Java bindings"
   - Example C–4, "Basic Call with SOAPElement, but without parameter registration"
   - Example C–6, "Basic Call with document-literal invocation and SOAPElement, but without parameter registration"
2. Register parameters.
   - Case 1: You are constructing the SOAP request yourself as a `SOAPElement`, and are receiving the response as a `SOAPElement`. In this case, you do not have to register parameters or return types. For examples of this case, see:
     - Example C–4, "Basic Call with SOAPElement, but without parameter registration"
     - Example C–6, "Basic Call with document-literal invocation and SOAPElement, but without parameter registration"
   - Case 2: You are explicitly registering the parameters and returns (parts) that are being used in the Web service invocation in your Basic Call, including the part name, the XML and Java type names, and the parameter mode. In this case, you can furnish the individual parameters as Java object instances. For an example of this case, see:
     - Example C–1, "Basic Call with parameter registration and Java bindings"
3. Invoke the Web service. You can invoke the Web service either by using `SOAPElement` or by Java bindings.
   - Case 1: Using `SOAPElement`. If you are using a document-literal invocation, then you will typically construct a `SOAPElement` for your message and pass it to the `invoke()` method. Note that this invocation employs the public, Oracle-specific API from `OracleCall`. For examples of this case, see:
     - Example C–4, "Basic Call with SOAPElement, but without parameter registration"
     - Example C–6, "Basic Call with document-literal invocation and SOAPElement, but without parameter registration"
   - Case 2: Using Java bindings. If you are using an RPC-literal or RPC-encoded invocation, then you will typically supply an array containing Java objects in

the `invoke()` method and cast the return object to the anticipated return type. For examples of this case, see:

- Example C–1, "Basic Call with parameter registration and Java bindings"
- Example C–2, "Configured Call with Java bindings, but without parameter registration"
- Example C–3, "Configured Call with registration of wrapper parameters and Java bindings"
- Example C–5, "Configured Call with a WSDL, complex return parameter registration, and Java bindings"
- Example C–7, "Configured Call with RPC-encoded invocation, complex parameter registration, and Java bindings"

Configured Calls

For a configured call, the call object is constructed from a WSDL. The following steps provide more information on how to construct a configured call.

1. Provide the WSDL for constructing the call object. For examples, see:
   - Example C–2, "Configured Call with Java bindings, but without parameter registration"
   - Example C–3, "Configured Call with registration of wrapper parameters and Java bindings"
   - Example C–5, "Configured Call with a WSDL, complex return parameter registration, and Java bindings"
   - Example C–7, "Configured Call with RPC-encoded invocation, complex parameter registration, and Java bindings"
2. Register parameters. For a Configured Call, you must register parameters for the following cases:
   - Case 1: You are employing a complex or other type that is not being mapped to a primitive Java type (or an Object variant of a primitive Java type). For examples of this case, see:
     - Example C–5, "Configured Call with a WSDL, complex return parameter registration, and Java bindings"
     - Example C–7, "Configured Call with RPC-encoded invocation, complex parameter registration, and Java bindings".
   - Case 2: You are using a document-literal wrapped style and do not want to create a `SOAPElement` like the ones illustrated in Example C–4 and Example C–6 for Basic Call. In this case, the name of the parameter must be the `QName` of the wrapper. For an example of this case, see:
     - Example C–3, "Configured Call with registration of wrapper parameters and Java bindings"
   - Case 3: If Case 1 and Case 2 do not apply, then you do not have to register parameters or returns. For an example of this case, see:
     - Example C–2, "Configured Call with Java bindings, but without parameter registration"
3. Invoke the Web service. You can invoke the Web service either by using `SOAPElement` or by Java bindings.

- Case 1: Using `SOAPElement`. If you are using a document-literal invocation, then you will typically construct a `SOAPElement` for your message and pass it to the `invoke()` method. Note that this invocation employs the public, Oracle-specific API from `OracleCall`. For examples of this case, see:
  - Example C–4, "Basic Call with SOAPElement, but without parameter registration"
  - Example C–6, "Basic Call with document-literal invocation and SOAPElement, but without parameter registration"
- Case 2: Using Java bindings. If you are using an RPC-literal or RPC-encoded invocation, then you will typically supply an array containing Java objects in the `invoke()` method and cast the return object to the anticipated return type. For examples of this case, see:
  - Example C–1, "Basic Call with parameter registration and Java bindings"
  - Example C–2, "Configured Call with Java bindings, but without parameter registration"
  - Example C–3, "Configured Call with registration of wrapper parameters and Java bindings"
  - Example C–5, "Configured Call with a WSDL, complex return parameter registration, and Java bindings"
  - Example C–7, "Configured Call with RPC-encoded invocation, complex parameter registration, and Java bindings"

Examples of Web Service Clients that use DII

This section provides a variety of client examples that use basic calls or configured calls to invoke a Web service.

The following code snippet illustrates an `import` statement that can be used by the following code examples.

```
import javax.xml.rpc.ServiceFactory;
import javax.xml.rpc.Service;
import javax.xml.rpc.Call;
import javax.xml.rpc.ParameterMode;
import javax.xml.namespace.QName;
import javax.xml.soap.SOAPFactory;
import javax.xml.soap.SOAPElement;
import java.net.URL;
import oracle.webservices.OracleCall;
import oracle.xml.parser.v2.XMLElement;
```

Example C–1 Basic Call with parameter registration and Java bindings

```
// (1) Creation of call object without WSDL.
String endpoint = "http://localhost:8888/echo/DiiDocEchoService";
ServiceFactory sf = ServiceFactory.newInstance();
Service service = sf.createService(new QName("http://echo.demo.oracle/", "tns"));
Call call = service.createCall();

// (2) Configuration of call and registration of parameters.
call.setTargetEndpointAddress(endpoint);
call.setProperty(Call.SOAPACTION_USE_PROPERTY, new Boolean(true));
```

```
call.setProperty(Call.SOAPACTION_URI_PROPERTY, "");
call.setProperty(Call.ENCODINGSTYLE_URI_PROPERTY,
"http://schemas.xmlsoap.org/soap/encoding/");
call.setProperty(Call.OPERATION_STYLE_PROPERTY, "rpc");
QName QNAME_TYPE_STRING = new QName("http://www.w3.org/2001/XMLSchema", "string");
call.addParameter("s", QNAME_TYPE_STRING, ParameterMode.IN);
call.setReturnType(QNAME_TYPE_STRING);

// (3) Invocation.
System.out.println("Response is " + call.invoke(new Object[]{"hello"}));
```

Example C–2 Configured Call with Java bindings, but without parameter registration

```
/// (1) Creation of call object using WSDL.
String namespace = "http://www.xmethods.net/sd/CurrencyExchangeService.wsdl";
URL wsdl=new URL(namespace);
ServiceFactory factory = ServiceFactory.newInstance();
QName serviceName = new QName(namespace, "CurrencyExchangeService");
Service service = factory.createService(wsdl, serviceName);
QName portName = new QName(namespace, "CurrencyExchangePort");
Call call = service.createCall(portName);

// (2) Registration of parameters.
//     -> taken from the WSDL

// (3) Configuration of operation and invocation.
QName operationName = new QName("urn:xmethods-CurrencyExchange", "getRate");
call.setOperationName(operationName);
Float rate = (Float) call.invoke(new Object[]{"usa", "canada"});
System.out.println("getRate: " + rate);
```

Example C–3 Configured Call with registration of wrapper parameters and Java bindings

```
// (1) Creation of call object using WSDL.
String namespace = "http://server.hello/jaxws";
ServiceFactory factory = ServiceFactory.newInstance();
QName serviceName = new QName(namespace, "HelloImplService");
URL wsdl=new URL(namespace+"?WSDL");
Service service = factory.createService(wsdl, serviceName);
QName portName = new QName(namespace, "HelloImpl");
Call call = service.createCall(portName);

// (2) Registration of SayHello and SayHelloResponse wrapper classes
//     These must be available in the classpath.
String TYPE_NAMESPACE_VALUE = "http://server.hello/jaxws";
QName reqQname = new QName(TYPE_NAMESPACE_VALUE,"sayHelloElement");
QName respQName = new QName(TYPE_NAMESPACE_VALUE,"sayHelloResponseElement");
call.addParameter("name", reqQname, SayHello.class, ParameterMode.IN );
call.setReturnType(respQName, SayHelloResponse.class );

// (3) Invocation
SayHello input = new SayHello("Duke");
Object[] params = new Object[] { input };
SayHelloResponse result = (SayHelloResponse) call.invoke( params );
String response = result.getResult();
```

Example C–4 Basic Call with SOAPElement, but without parameter registration

```
// (1) Creation of call object without WSDL
ServiceFactory sf = ServiceFactory.newInstance();
Service service = sf.createService(new QName("http://echo.demo.oracle/", "tns"));
Call call = service.createCall();
call.setTargetEndpointAddress("http://localhost:8888/echo/DiiDocEchoService");

// (2) No registration of parameters

// (3a) Direct creation of payload as SOAPElement
SOAPFactory soapfactory = SOAPFactory.newInstance();
SOAPElement m1 = soapfactory.createElement("echoStringElement", "tns",
"http://echo.demo.oracle/");
SOAPElement m2 = soapfactory.createElement("s", "tns",
"http://echo.demo.oracle/");
m2.addTextNode("Bob");
m1.addChildElement(m2);
System.out.println("Request is: ");
((XMLElement) m1).print(System.out);

// (3b) Invocation
SOAPElement resp = (SOAPElement) ((OracleCall) call).invoke(m1);
System.out.println("Response is: ");
((XMLElement) resp).print(System.out);
```

Example C–5 Configured Call with a WSDL, complex return parameter registration, and Java bindings

```
// (0) Preparing a complex argument value
Integer  req_I = new Integer( Integer.MAX_VALUE );
String   req_s = "testDocLitBindingAnonymAll & <body>";
Integer  req_inner_I = new Integer( Integer.MIN_VALUE );
String   req_inner_s = "<inner> & <body>";
int[]    req_inner_i = {0,Integer.MAX_VALUE, Integer.MIN_VALUE};
InnerSequence req_inner = new InnerSequence();
req_inner.setVarInteger( req_inner_I );
req_inner.setVarString ( req_inner_s );
req_inner.setVarInt    ( req_inner_i );
EchoAnonymAllElement req = new EchoAnonymAllElement();
req.setVarInteger   ( req_I );
req.setVarString    ( req_s );
req.setInnerSequence( req_inner);

// (1) Creation of call object using the WSDL
String TARGET_NS = "http://soapinterop.org/DocLitBinding";
String TYPE_NS = "http://soapinterop.org/xsd";
String XSD_NS = "http://www.w3.org/2001/XMLSchema";
QName SERVICE_NAME = new QName( TARGET_NS, "DocLitBindingService" );
QName PORT_NAME = new QName( TARGET_NS, "DocLitBindingPort");
String wsdlUrl = "http://"+getProperty("HOST")+
                 ":"+getProperty("HTTP_PORT")+
                 "/doclit_binding/doclit_binding";
```

```
QName operation = new QName(TARGET_NS, "echoAnonymAll");
ServiceFactory factory = ServiceFactory.newInstance();
Service srv = factory.createService( new URL(wsdlUrl + "?WSDL"), SERVICE_NAME);
Call call = srv.createCall( PORT_NAME, operation );

// (2) Registration of complex return parameter
call.setReturnType(new QName(TYPE_NS, "EchoAnonymAllElement"),
EchoAnonymAllElement.class);

// (3) Invocation
EchoAnonymAllElement res = (EchoAnonymAllElement) call.invoke( new Object[]{req}
);
System.out.println( "AnonymAll body  : " +res.getVarString() );
System.out.println( "AnonymAll inner : " +res.getInnerSequence() );
```

Example C–6 Basic Call with document-literal invocation and SOAPElement, but without parameter registration

```
// (1) Creation of Basic Call
ServiceFactory sf = ServiceFactory.newInstance();
Service service = sf.createService(new QName("http://echo.demo.oracle/", "tns"));
String endpoint="http://localhost:8888/test/echo";
Call call = service.createCall();
call.setTargetEndpointAddress(endpoint);

// (2) No parameter registration

// (3) Invocation using SOAPElement
SOAPFactory soapfactory = SOAPFactory.newInstance();
SOAPElement m1 = soapfactory.createElement("echoStringElement", "tns",
"http://echo.demo.oracle/");
SOAPElement m2 = soapfactory.createElement("s", "tns",
"http://echo.demo.oracle/");
m2.addTextNode("Bob");
m1.addChildElement(m2);
System.out.println("Request is: ");
((XMLElement) m1).print(System.out);
SOAPElement resp = (SOAPElement) ((OracleCall) call).invoke(m1);
System.out.println("Response is: ");
((XMLElement) resp).print(System.out);
```

Example C–7 Configured Call with RPC-encoded invocation, complex parameter registration, and Java bindings

```
// (1) Creation of ConfiguredCall using WSDL
ServiceFactory sf = ServiceFactory.newInstance();
String endpoint="http://localhost:8888/test/echo";
Service service = sf.createService(new java.net.URL(endpoint + "?WSDL"), new
QName("http://echo.demo.oracle/", "DiiRpcEchoService"));
Call call = service.createCall(new QName("http://echo.demo.oracle/",
"HttpSoap11"), new QName("http://echo.demo.oracle/", "echoStrings"));
call.setProperty(Call.SOAPACTION_USE_PROPERTY, new Boolean(true));
call.setProperty(Call.SOAPACTION_URI_PROPERTY, "");
call.setProperty(Call.ENCODINGSTYLE_URI_PROPERTY,
"http://schemas.xmlsoap.org/soap/encoding/");
call.setProperty(Call.OPERATION_STYLE_PROPERTY, "rpc");
```

```
// (2) Registration of complex input and return arguments
QName stringArray = new QName("http://echo.demo.oracle/", "stringArray");
call.addParameter("s", stringArray, String[].class, ParameterMode.IN);
call.setReturnType(stringArray, String[].class);

// (3) Invocation
String[] request = new String[]{"bugs", "little_pieces", "candy"};
String[] resp = (String[]) call.invoke(new Object[]{request});
System.out.println("Response is: ");
for (int i = 0; i < resp.length; i++) {
   System.out.print(resp[i] + " ");
}
System.out.println();
```

D

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