This document introduces you to Oracle Infrastructure Web services.
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This preface describes the intended audience, document accessibility features, and conventions used in this guide—Concepts Guide for Oracle Infrastructure Web Services.

Audience

This document is intended for programmers that are developing Oracle Infrastructure Web services, including SOA, ADF, and WebCenter services.

Documentation Accessibility

Our goal is to make Oracle products, services, and supporting documentation accessible to all users, including users that are disabled. To that end, our documentation includes features that make information available to users of assistive technology. This documentation is available in HTML format, and contains markup to facilitate access by the disabled community. Accessibility standards will continue to evolve over time, and Oracle is actively engaged with other market-leading technology vendors to address technical obstacles so that our documentation can be accessible to all of our customers. For more information, visit the Oracle Accessibility Program Web site at http://www.oracle.com/accessibility/.

Accessibility of Code Examples in Documentation

Screen readers may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, some screen readers may not always read a line of text that consists solely of a bracket or brace.

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This documentation may contain links to Web sites of other companies or organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these Web sites.

Deaf/Hard of Hearing Access to Oracle Support Services

To reach Oracle Support Services, use a telecommunications relay service (TRS) to call Oracle Support at 1.800.223.1711. An Oracle Support Services engineer will handle technical issues and provide customer support according to the Oracle service request process. Information about TRS is available at http://www.fcc.gov/cgb/consumerfacts/trs.html, and a list of phone numbers is available at http://www.fcc.gov/cgb/dro/trsphonebk.html.
Related Documents

For more information, see the following documents in the Oracle Fusion Middleware 11g Release 1 (11.1.1) documentation set:

- *Oracle Fusion Middleware Introducing Web Services*
- *Oracle Fusion Middleware Security and Administrator’s Guide for Web Services*
- *Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite*
- *Oracle Fusion Middleware Fusion Developer’s Guide for Oracle Application Development Framework*
- *Oracle Fusion Middleware Developer’s Guide for Oracle WebCenter*

Conventions

The following text conventions are used in this document:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>boldface</strong></td>
<td>Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.</td>
</tr>
<tr>
<td><em>italic</em></td>
<td>Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.</td>
</tr>
<tr>
<td><strong>monospace</strong></td>
<td>Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.</td>
</tr>
</tbody>
</table>
This chapter introduces Oracle Infrastructure Web services and describes the standards supported.

- Section 1.1, "Overview of Oracle Infrastructure Web Services"
- Section 1.2, "Types of Oracle Infrastructure Web Services and Clients"
- Section 1.3, "Supported Standards"
- Section 1.4, "Related Documentation"

### 1.1 Overview of Oracle Infrastructure Web Services

In Oracle Fusion Middleware 11g, there are two categories of Web services to support the development, security, and administration of the following types of Web services:

- Oracle Infrastructure Web services—SOA, ADF, and Web Center services
- WebLogic Web services (Java EE Web services)

The following figure illustrates the two Web services categories. Oracle Infrastructure Web services are highlighted (in yellow) in the figure.

**Figure 1–1  Web Services in Oracle Fusion Middleware 11g**
This chapter describes concepts for developing Oracle Infrastructure Web services. For more information about WebLogic Web services, see Oracle Fusion Middleware Introducing WebLogic Web Services for Oracle WebLogic Server.

### 1.2 Types of Oracle Infrastructure Web Services and Clients

Table 1–1 summarizes the types of Oracle Infrastructure Web services supported in Oracle Fusion Middleware 11g.

<table>
<thead>
<tr>
<th>Web Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOA service components</strong></td>
<td>SOA composite applications include SOA service components. SOA service components are the basic building blocks of SOA applications, implementing a part of the overall business logic functionality. The following SOA service components can be managed using Oracle WSM:</td>
</tr>
<tr>
<td></td>
<td>■ BPEL Process—Provides process orchestration and storage of synchronous and asynchronous processes.</td>
</tr>
<tr>
<td></td>
<td>■ Oracle Mediator—Routes events (messages) between different components.</td>
</tr>
<tr>
<td></td>
<td>■ Human Workflow—Enables you to model a workflow that describes the tasks for users or groups to perform as part of an end-to-end business process flow.</td>
</tr>
<tr>
<td></td>
<td>■ Business Rules—Design a business decision based on rules.</td>
</tr>
<tr>
<td></td>
<td>For more information about developing SOA service components, see Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.</td>
</tr>
<tr>
<td></td>
<td>You can deploy SOA service components to the Oracle Fusion Middleware environment.</td>
</tr>
<tr>
<td><strong>SOA service binding components</strong></td>
<td>SOA Service binding components provide the outside world with an entry point to the SOA composite application. The WSDL file of the service advertises its capabilities to external applications. These capabilities are used for contacting the SOA composite application components. For more information, see Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.</td>
</tr>
</tbody>
</table>
Supported Standards

Introducing Oracle Infrastructure Web Services

Table 1–2 summarizes the types of Oracle Infrastructure Web service clients supported in Oracle Fusion Middleware 11g.

<table>
<thead>
<tr>
<th>Web Service Client</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOA reference binding components</td>
<td>SOA reference binding components connect the SOA composite application to external partners. For more information about developing SOA reference binding components, see Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.</td>
</tr>
<tr>
<td>ADF Web applications</td>
<td>ADF Web applications can invoke a service, such as a WebLogic Web service, a SOA composite application, or an ADF Business Component, using a Web service data control or Web service proxy. For more information, see &quot;Integrating Web Services into a Fusion Web Application&quot; in Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.</td>
</tr>
<tr>
<td>WebCenter portlets</td>
<td>WebCenter portlets enable you to surface WebCenter services. For more information about developing WebCenter portlets, see Oracle Fusion Middleware Developer’s Guide for Oracle WebCenter.</td>
</tr>
</tbody>
</table>

1.3 Supported Standards

The following table summarizes the Oracle Infrastructure Web service specifications that are part of the Oracle implementation, organized by high-level feature.

Oracle considers interoperability of Web services platforms to be more important than providing support for all possible edge cases of the Web services specifications. Oracle
complies with the following specifications from the Web Services Interoperability Organization and considers them to be the baseline for Web services interoperability:

- **Basic Profile 1.1 and 1.0:**  

- **Basic Security Profile 1.0:**  
  [http://www.ws-i.org/Profiles/BasicSecurityProfile-1.0.html](http://www.ws-i.org/Profiles/BasicSecurityProfile-1.0.html)

- **WS-I Attachments Profile 1.0:**  
  [http://www.ws-i.org/Profiles/AttachmentsProfile-1.0.html](http://www.ws-i.org/Profiles/AttachmentsProfile-1.0.html)

**Note:** For more information about Oracle Infrastructure Web service security standards, see "Web Services Security Standards" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

### Table 1–3 Specifications Supported by Oracle Infrastructure Web Services

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
</table>
| Web service description | **Web Services Description Language (WSDL) 1.1 and 2.0**—XML-based specification that describes a Web service. For more information, see Web Services Description Language (WSDL) at [http://www.w3.org/TR/wsd1](http://www.w3.org/TR/wsd1).  
**Web Services Policy Framework (WS-Policy) 1.2**—General purpose model and corresponding syntax to describe and communicate the policies of a Web service. For more information, see WS-Policy 1.2 Framework (Member Submission): [http://www.w3.org/Submission/WS-Policy](http://www.w3.org/Submission/WS-Policy).  
**Web Services Policy Attachment (WS-PolicyAttachment) 1.5 and 1.2**—Abstract model and an XML-based expression grammar for policies. For more information, see:  
WS-Policy Attachment 1.5 (Recommendation): [http://www.w3.org/TR/ws-policy-attach/](http://www.w3.org/TR/ws-policy-attach/)  
| Data exchange between Web service and requesting client | **Simple Object Access Protocol (SOAP) 1.1 and 1.2**—Lightweight XML-based protocol used to exchange information in a decentralized, distributed environment. For more information, see Simple Object Access Protocol (SOAP) at [http://www.w3.org/TR/SOAP](http://www.w3.org/TR/SOAP).  
**SOAP with Attachments API for Java (SAAJ) 1.3**—Implementation that developers can use to produce and consume messages conforming to the SOAP 1.1 specification and SOAP with Attachments notes. For more information, see the SOAP with Attachments API for Java (SAAJ) specification at [https://saaj.dev.java.net](https://saaj.dev.java.net).  
**Message Transmission Optimization Mechanism (MTOM)** you can specify that a Web service use a streaming API when reading inbound SOAP messages that include attachments, rather than the default behavior in which the service reads the entire message into memory. For more information, see SOAP Message Transmission Optimization Mechanism specification at [http://www.w3.org/TR/soap12-mtom/](http://www.w3.org/TR/soap12-mtom/). |
### Supported Standards

#### Security
- **Security Assertion Markup Language (SAML) 2.0**—XML standard for exchanging authentication and authorization data between security domains. For more information, see the [Security Assertion Markup Language (SAML)](http://docs.oasis-open.org/security/saml/v2.0/) specification at [http://docs.oasis-open.org/security/saml/v2.0/](http://docs.oasis-open.org/security/saml/v2.0/).
- **Security Assertion Markup Language (SAML) Token Profile 1.1**—Set of SOAP extensions that implement SOAP message authentication and encryption. For more information, see the [Security Assertion Markup Language (SAML) Token Profile 1.1](http://www.oasis-open.org/committees/download.php/16768/wss-v1.1-spec-os-SAMLTokenProfile.pdf).
- **XML Signature**—Defines an XML syntax for digital signatures. For more information, see [XML Signature Syntax and Processing](http://www.w3.org/TR/xmldsig-core/).
- **XML Encryption**—Defines how to encrypt the contents of an XML element. For more information, see [XML Encryption Syntax and Processing](http://www.w3.org/TR/xmlenc-core/).

#### Reliable communication
- **Web Services Addressing (WS-Addressing) 1.0**—Transport-neutral mechanisms to address Web services and messages. For more information, see Web Services Addressing (WS-Addressing) specification at [http://www.w3.org/TR/ws-addr-core](http://www.w3.org/TR/ws-addr-core).
- **Web Services Reliable Messaging (WS-ReliableMessaging) 1.0 and 1.1**—Implementation that enables two Web services running on different WebLogic Server instances to communicate reliably in the presence of failures in software components, systems, or networks. For more information, see: [Web Services Reliable Messaging (WS-ReliableMessaging) 1.1](http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.pdf).

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**Table 1–3 (Cont.) Specifications Supported by Oracle Infrastructure Web Services**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security Assertion Markup Language (SAML) 2.0</strong>—XML standard for exchanging authentication and authorization data between security domains. For more information, see the <a href="http://docs.oasis-open.org/security/saml/v2.0/">Security Assertion Markup Language (SAML)</a> specification at <a href="http://docs.oasis-open.org/security/saml/v2.0/">http://docs.oasis-open.org/security/saml/v2.0/</a>.</td>
<td></td>
</tr>
<tr>
<td><strong>Security Assertion Markup Language (SAML) Token Profile 1.1</strong>—Set of SOAP extensions that implement SOAP message authentication and encryption. For more information, see the <a href="http://www.oasis-open.org/committees/download.php/16768/wss-v1.1-spec-os-SAMLTokenProfile.pdf">Security Assertion Markup Language (SAML) Token Profile 1.1</a>.</td>
<td></td>
</tr>
<tr>
<td><strong>XML Signature</strong>—Defines an XML syntax for digital signatures. For more information, see <a href="http://www.w3.org/TR/xmldsig-core/">XML Signature Syntax and Processing</a>.</td>
<td></td>
</tr>
<tr>
<td><strong>XML Encryption</strong>—Defines how to encrypt the contents of an XML element. For more information, see <a href="http://www.w3.org/TR/xmlenc-core/">XML Encryption Syntax and Processing</a>.</td>
<td></td>
</tr>
<tr>
<td><strong>Reliable communication</strong></td>
<td><strong>Web Services Addressing (WS-Addressing) 1.0</strong>—Transport-neutral mechanisms to address Web services and messages. For more information, see Web Services Addressing (WS-Addressing) specification at <a href="http://www.w3.org/TR/ws-addr-core">http://www.w3.org/TR/ws-addr-core</a>.</td>
</tr>
<tr>
<td><strong>Web Services Reliable Messaging (WS-ReliableMessaging) 1.0 and 1.1</strong>—Implementation that enables two Web services running on different WebLogic Server instances to communicate reliably in the presence of failures in software components, systems, or networks. For more information, see: <a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.pdf">Web Services Reliable Messaging (WS-ReliableMessaging) 1.1</a>.</td>
<td></td>
</tr>
</tbody>
</table>
1.4 Related Documentation

The following table summarizes the documentation that is related to Oracle Infrastructure Web services development, security, and administration.

<table>
<thead>
<tr>
<th>Document</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle Fusion Middleware Introducing Web Services</td>
<td>This document. Provides an introduction to Web services for Oracle Fusion Middleware 11g.</td>
</tr>
<tr>
<td>Oracle Fusion Middleware Security and Administrator’s Guide for Web Services</td>
<td>Describes how to secure and administer Web services.</td>
</tr>
<tr>
<td>Oracle Fusion Middleware Interoperability Guide for Oracle Web Services Manager</td>
<td>Describes how to implement the most common Oracle Web Services Manager (Oracle WSM) interoperability scenarios.</td>
</tr>
<tr>
<td>Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite</td>
<td>Describes how to develop SOA composite services.</td>
</tr>
<tr>
<td>Oracle Fusion Middleware Developer’s Guide for Oracle WebCenter</td>
<td>Describes how to develop WebCenter services.</td>
</tr>
<tr>
<td>&quot;Developing with Web Services” in the “Designing and Developing Applications” section of the Oracle JDeveloper online help</td>
<td>Describes how to develop Web services and attach policies using Oracle JDeveloper.</td>
</tr>
<tr>
<td>Oracle Workshop for WebLogic Server</td>
<td>Explains how to use Workshop to write and manage source code and design with sophisticated visual tools and Java frameworks.</td>
</tr>
</tbody>
</table>
This chapter describes how to attach policies to Oracle Infrastructure Web services.

- Section 2.1, "What Are Policies?"
- Section 2.2, "Oracle WSM Predefined Policies and Assertion Templates"
- Section 2.3, "Attaching Policies to Web Services Using Annotations"
- Section 2.4, "Attaching Policies Using Oracle JDeveloper"
- Section 2.5, "Attaching Policies Using Oracle Enterprise Manager"

2.1 What Are Policies?

Policies describe the capabilities and requirements of a Web service such as whether and how a message must be secured, whether and how a message must be delivered reliably, and so on.

Oracle Fusion Middleware 11g Release 1 (11.1.1) supports the types of policies defined in Table 2–1.

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-ReliableMessaging</td>
<td>Reliable messaging policies that implement the WS-ReliableMessaging standard describes a wire-level protocol that allows guaranteed delivery of SOAP messages, and can maintain the order of sequence in which a set of messages are delivered. The technology can be used to ensure that messages are delivered in the correct order. If a message is delivered out of order, the receiving system can be configured to guarantee that the messages will be processed in the correct order. The system can also be configured to deliver messages at least once, not more than once, or exactly once. If a message is lost, the sending system re-transmits the message until the receiving system acknowledges it receipt.</td>
</tr>
<tr>
<td>Management</td>
<td>Management policies that log request, response, and fault messages to a message log. Management policies may include custom policies.</td>
</tr>
</tbody>
</table>
Oracle WSM Predefined Policies and Assertion Templates

2.2 Oracle WSM Predefined Policies and Assertion Templates

Oracle Web Services Manager (WSM) provides a policy framework to manage and secure Web services consistently across your organization. Oracle WSM can be used by both developers, at design time, and system administrators in production environments. For more information about the Oracle WSM policy framework, see "Understanding Oracle WSM Policy Framework" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

There is a set of predefined Oracle WSM policies and assertion templates that are automatically available when you install Oracle Fusion Middleware. The predefined policies are based on common best practice policy patterns used in customer deployments.

You can immediately begin attaching these predefined policies to your Web services or clients. You can configure the predefined policies or create a new policy by making a copy of one of the predefined policies.

Predefined policies are constructed using assertions based on predefined assertion templates. You can create new assertion templates, as required.

For more information about the predefined Oracle WSM policies and assertion templates, see the following sections in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services:

- "Predefined Policies"
- "Predefined Assertion Templates"

2.3 Attaching Policies to Web Services Using Annotations

You can use annotations defined in Table 2–2 to attach policies to Web services. The annotations are included in the oracle.webservices.annotations and oracle.webservices.annotations.async packages.
For more information about the annotations available, see Oracle Fusion Middleware Java API Reference for Oracle Web Services. For more information about the predefined policies, see “Predefined Policies” in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

Table 2–2 Annotations for Attaching Policies to Web Services

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@AddressingPolicy</td>
<td>Attaches a WS-Addressing policy to the Web service. For more information, see Section A.2, “@AddressingPolicy Annotation”.</td>
</tr>
<tr>
<td>@CallbackManagementPolicy</td>
<td>Attaches a management policy to the callback client of the asynchronous Web service that will connect to the callback service. For more information, see Section A.8, “@CallbackManagementPolicy Annotation”.</td>
</tr>
<tr>
<td>@CallbackMtomPolicy</td>
<td>Attaches an MTOM policy to the callback client of the asynchronous Web service that will connect to the callback service. For more information, see Section A.9, “@CallbackMtomPolicy Annotation”.</td>
</tr>
<tr>
<td>@CallbackSecurityPolicy</td>
<td>Attaches one or more security policies to the callback client of the asynchronous Web service that will connect to the callback service. By default, no security policies are attached. For more information, see Section A.12, “@CallbackSecurityPolicy Annotation”.</td>
</tr>
<tr>
<td>@ManagementPolicy</td>
<td>Attaches a management policy to the Web service. For more information, see Section A.13, “@ManagementPolicy Annotation”.</td>
</tr>
<tr>
<td>@MtomPolicy</td>
<td>Attaches an MTOM policy to the Web service. For more information, see Section A.14, “@MtomPolicy Annotation”.</td>
</tr>
<tr>
<td>@ReliabilityPolicy</td>
<td>Attaches a reliable messaging policy to the Web service. For more information, see Section A.16, “@ReliabilityPolicy Annotation”.</td>
</tr>
<tr>
<td>@SecurityPolicies</td>
<td>Specifies an array of @SecurityPolicy annotations. Use this annotation if you want to attach more than one WS-Policy files to a class. For more information, see Section A.18, “@SecurityPolicies Annotation”.</td>
</tr>
<tr>
<td>@SecurityPolicy</td>
<td>Attaches a security policy to the Web service. For more information, see Section A.19, “@SecurityPolicy Annotation”.</td>
</tr>
</tbody>
</table>

2.4 Attaching Policies Using Oracle JDeveloper

When creating an application using JDeveloper, you can take advantage of the wizards available to attach policies to Web services and clients.

For example, the following figure shows the Configure SOA WS Policies wizard that you can use to attach policies to SOA service or reference binding component quickly and easily.
For more information, see:

- "Creating Web Service Proxies" in the JDeveloper Online Help.

2.5 Attaching Policies Using Oracle Enterprise Manager

After a Web service or client is deployed, you can attach policies using the Oracle Enterprise Manager.

For example, Figure 2–2 shows the Policies tab on the Web Service Endpoint page from which you can attach policies to a Web service endpoint.
Complete details are provided in the following sections of Oracle Fusion Middleware Security and Administrator’s Guide for Web Services:

- "Attaching a Policy to a Single Subject"
- "Attaching a Policy to Multiple Subjects (Bulk Attachment)"
- "Attaching Policies to Web Service Clients"
This chapter describes how to secure Oracle Infrastructure Web services.

- **Section 3.1, "Overview of Web Services Security"**
- **Section 3.2, "Oracle WSM Predefined Security Policies and Assertion Templates"**
- **Section 3.3, "Attaching Security Policies"**
- **Section 3.4, "Configuring Security Policies"**

### 3.1 Overview of Web Services Security

Web services security includes several aspects:

- **Authentication**—Verifying that the user is who she claims to be. A user’s identity is verified based on the credentials presented by that user, such as:
  1. Something one has, for example, credentials issued by a trusted authority such as a passport (real world) or a smart card (IT world).
  2. Something one knows, for example, a shared secret such as a password.
  3. Something one is, for example, biometric information.

Using a combination of several types of credentials is referred to as "strong" authentication, for example using an ATM card (something one has) with a PIN or password (something one knows).

- **Authorization (or Access Control)**—Granting access to specific resources based on an authenticated user’s entitlements. Entitlements are defined by one or several attributes. An attribute is the property or characteristic of a user, for example, if "Marc" is the user, "conference speaker" is the attribute.

- **Confidentiality, privacy**—Keeping information secret. Accesses a message, for example a Web service request or an email, as well as the identity of the sending and receiving parties in a confidential manner. Confidentiality and privacy can be achieved by encrypting the content of a message and obfuscating the sending and receiving parties’ identities.

- **Integrity, non repudiation**—Making sure that a message remains unaltered during transit by having the sender digitally sign the message. A digital signature is used to validate the signature and provides non-repudiation. The timestamp in the signature prevents anyone from replaying this message after the expiration.

For more information about these Web services security concepts, see "Understanding Web Services Security Concepts" in *Oracle Fusion Middleware Security and Administrator’s Guide for Web Services*. 
Oracle Web Services Manager (WSM) is designed to define and implement Web services security in heterogeneous environments, including authentication, authorization, message encryption and decryption, signature generation and validation, and identity propagation across multiple Web services used to complete a single transaction. In addition, Oracle WSM provides tools to manage Web services based on service-level agreements. For example, the user (a security architect or a systems administrator) can define the availability of a Web service, its response time, and other information that may be used for billing purposes. For more information about Oracle WSM, see "Understanding Oracle WSM Policy Framework" in Oracle Fusion Middleware Security and Administrator's Guide for Web Services.

3.2 Oracle WSM Predefined Security Policies and Assertion Templates

As described in Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services," Oracle WSM provides a set of predefined policies and assertion templates that are automatically available when you install Oracle Fusion Middleware.

The following categories of security policies and assertion templates are available out-of-the-box:

- Authentication Only Policies
- Message Protection Only Policies
- Message Protection and Authentication Policies
- Authorization Only Policies

For complete details about the predefined security policies and assertion template, see the following sections in Oracle Fusion Middleware Security and Administrator's Guide for Web Services:

- "Security Policies"
- "Security Assertion Templates"

For assistance in determining which security policies to use, see "Determining Which Security Policies to Use" in Oracle Fusion Middleware Security and Administrator's Guide for Web Services.

3.3 Attaching Security Policies

You can attach security policies to Oracle Infrastructure Web services and clients at design time using Oracle JDeveloper, or runtime using the Oracle Enterprise Manager. For more information, see Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services."

3.4 Configuring Security Policies

You must configure the security policies before you can use them in your environment. The steps to configure security policies are described in "Configuring Policies" in Oracle Fusion Middleware Security and Administrator's Guide for Web Services.

The following table provides references to the configuration steps for each policy category.
### Table 3–1 Configuring Security Policies

<table>
<thead>
<tr>
<th>Policy Category</th>
<th>Configuration Steps in Security and Administrator’s Guide for Web Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentication Only Policies</td>
<td>“Authentication-Only Policies and Configuration Steps”</td>
</tr>
<tr>
<td>Message Protection and Authentication Policies</td>
<td>“Message Protection and Authentication Policies and Configuration Steps”</td>
</tr>
</tbody>
</table>
Developing Asynchronous Web Services

The JAX-WS specification provides an asynchronous client API that enables you to call synchronous methods in an asynchronous way. This chapter introduces asynchronous Web service concepts and describes how to develop and configure asynchronous Web services.

- Section 4.1, "Overview of Asynchronous Web Services"
- Section 4.2, "Using JDeveloper to Develop and Deploy Asynchronous Web Services"
- Section 4.3, "Developing an Asynchronous Web Service"
- Section 4.4, "Configuring the Request and Response Queues"
- Section 4.5, "Configuring the Callback Service"
- Section 4.6, "Defining Asynchronous Web Service Clients"
- Section 4.7, "Attaching Policies to Asynchronous Web Services and Clients"

4.1 Overview of Asynchronous Web Services

When you invoke a Web service synchronously, the invoking client application waits for the response to return before it can continue with its work. In cases where the response returns immediately, this method of invoking the Web service might be adequate. However, because request processing can be delayed, it is often useful for the client application to continue its work and handle the response later on. By calling a Web service asynchronously, the client can continue its processing, without interrupt, and will be notified when the asynchronous response is returned.

The following sections step through several asynchronous message flow diagrams, provide the perspective from the client-side, and explain how asynchronous messages are correlated:

- Section 4.1.1, "Asynchronous Web Service Using a Single Request Queue"
- Section 4.1.2, "Asynchronous Web Service Using a Request and a Response Queue"
- Section 4.1.3, "Client Perspective of Asynchronous Web Service Call"
- Section 4.1.4, "How Asynchronous Messages Are Correlated"
4.1.1 Asynchronous Web Service Using a Single Request Queue

**Note:** Although the single request queue scenario may provide better performance, it is less reliable than the request and response queue scenario. Oracle recommends that you use the request and response queue scenario, described in Section 4.1.2, “Asynchronous Web Service Using a Request and a Response Queue”, and not the single request queue scenario.

In this scenario, there is a single message-driven bean (MDB) associated with the request queue that handles both the request and response processing.

The following figure shows the flow of an asynchronous method call using a single request queue.

**Figure 4–1 Asynchronous Web Service Using a Single Request Queue**

The following describes the flow shown in the previous figure:

1. The client calls an asynchronous method.
2. The asynchronous Web services receives the request and stores it in the request queue.
3. The asynchronous Web service sends a receipt confirmation to the client.
4. The MDB listener on the request queue receives the message and initiates processing of the request.
5. The request MDB calls the required method in the Web service implementation.
6. The Web service implementation returns the response.
7. The request MDB, acting as a callback client, returns the response to the callback service.
8. The callback service returns a receipt confirmation message.
9. The request MDB returns a confirmation message to the request queue to terminate the process.

In this scenario, if there is a problem connecting to the callback service (in Step 7), then the response will not be sent. If the request is retried later, the flow resumes from Step 4 and the Web service implementation will be called again (in Step 5). This may not be desirable depending on your application logic or transactional control processing. In the next scenario, the response is stored in a separate response queue, eliminating the
need to recall the Web service implementation in the event that the callback service is not available initially.

4.1.2 Asynchronous Web Service Using a Request and a Response Queue

In this scenario, there are two MDBs, one to handle the request processing and one to handle the response processing. By separating the execution of business logic from the response return, this scenario provides improved error recovery over the single queue model described in Section 4.1.1, "Asynchronous Web Service Using a Single Request Queue".

The following figure shows the flow of an asynchronous method call using a single request queue.

**Figure 4–2  Asynchronous Web Service Using a Request and Response Queue**

The following describes the flow shown in the previous figure:

1. The client calls an asynchronous method.
2. The asynchronous Web services receives the request and stores it in the request queue.
3. The asynchronous Web service sends a receipt confirmation to the client.
4. The MDB listener on the request queue receives the message and initiates processing of the request.
5. The request MDB calls the required method in the Web service implementation.
6. The Web service implementation returns the response.
7. The request MDB saves the response to the response queue.
8. The request MDB sends a confirmation to the request queue to terminate the process.
10. The response MDB, acting as the callback client, returns the response to the callback service.
11. The callback service returns a receipt confirmation message.
12. The response MDB returns a confirmation message to the response queue to terminate the sequence.

4.1.3 Client Perspective of Asynchronous Web Service Call

From the client perspective, the asynchronous method call consists of two one-way message exchanges, as shown in the following figure.

**Figure 4–3 Asynchronous Web Service Client Flow**

As shown in the previous figure, before initiating the asynchronous call, the client must deploy a callback service to listen for the response from the asynchronous Web service.

The message flow is as follows:

1. The client calls an asynchronous method.
2. The asynchronous Web services receives the request, sends a confirmation message to the initiating client, and starts process the request.
3. Once processing of the request is complete, the asynchronous Web service acts as a client to send the response back to the callback service.
4. The callback service sends a confirmation message to the asynchronous Web service.

4.1.4 How Asynchronous Messages Are Correlated

**Note:** Message correlation is handled automatically by the SOA runtime. This section is for informational purposes only.

When the callback service receives a response, it needs a way to correlate the response back to the original request. This is achieved using WS-Addressing and is handled automatically by the SOA runtime.

The client sets the following two fields in the WS-Addressing part of the SOAP header:

- **ReplyTo address**—Address of the callback service.
- **MessageID**—Unique ID that identifies the request. For example, a UUID.
The callback client sends the MessageId corresponding to the initial request in the relatesToId field in the WS-Addressing header. If additional data is required by the callback service to process the response, clients need to save the MessageID and data required to the data store.

### 4.2 Using JDeveloper to Develop and Deploy Asynchronous Web Services

You can develop and deploy asynchronous Web service methods for an ADF Business Component quickly and easily. For complete details, see "How to Generate Asynchronous Web Service Methods" in Developer’s Guide for Oracle Application Development Framework.

The following sections describe in more detail how an asynchronous Web service is implemented. In some cases, the information is provided for informational purposes only.

### 4.3 Developing an Asynchronous Web Service

A JAX-WS Web service can be declared an asynchronous Web service using the following annotation: oracle.webservices.annotations.async.AsyncWebService.

The following provides a very simple POJO example of an asynchronous Web service:

```java
import oracle.webservices.annotations.PortableWebService
import oracle.webservices.annotations.async.AsyncWebService

@PortableWebService
@AsyncWebService
public class HelloService {
    public String hello(String name) {
        return "Hi " + name;
    }
}
```

The generated WSDL for the asynchronous Web service contains two one-way operations defined as two portTypes: one for the asynchronous operation and one for the callback operation.

For example:

```xml
<wSDL:portType name="HelloService">
    <wSDL:operation name="hello">
        <wSDL:input message="tns:helloInput"
            xmlns:ns1="http://www.w3.org/2006/05/addressing/wSDL"
            ns1:Action=""/>
    </wSDL:operation>
</wSDL:portType>
<wSDL:portType name="HelloServiceResponse">
    <wSDL:operation name="helloResponse">
        <wSDL:input message="tns:helloOutput"
            xmlns:ns1="http://www.w3.org/2006/05/addressing/wSDL"
            ns1:Action=""/>
    </wSDL:operation>
</wSDL:portType>
```
4.4 Configuring the Request and Response Queues

Before you deploy your asynchronous Web services, you must configure the queues used to store the request and response.

4.4.1 Using the Default WebLogic JMS Queues

The process varies based on whether you are using a clustered or non-clustered domain, as described in the following sections.

4.4.1.1 Using the Default WebLogic JMS Queues in Clustered Domains

For clustered domains, you must create two JMS Uniform Distributed Destinations (UDDs). An offline WLST script is provided to assist you in adding the default queues to your clustered environment.

The script is available at the following location:

<MW_HOME>/oracle_common/webservices/bin/jrfws-async-createUDDs.py

The following provides an example of how you might execute this script:

java -classpath <some_path>/weblogic.jar weblogic.WLST ./jrfws-async-createUDDs.py -domain_home <domain> -cluster <cluster>

4.4.1.2 Using the Default WebLogic JMS Queues in Non-clustered Domains

For non-clustered domains, a pair of default WebLogic JMS queues are provided as part of the following WebLogic domain extension template: oracle.jrf.ws.async_template_11.1.1.jar. The default JMS queues included in the extension template include:

- Request queue: oracle.j2ee.ws.server.async.DefaultRequestQueue
- Response queue: oracle.j2ee.ws.server.async.DefaultResponseQueue

The default JMS connection factory, weblogic.jms.XAConnectionFactory, provided as part of the base domain, is used by default.

To take advantage of the default queues, when creating or extending your domain using the Fusion Middleware Configuration Wizard, select Oracle JRF Web Services Asynchronous services. For more information, see Oracle WebLogic Server Creating WebLogic Domains Using the Configuration Wizard.

Note: Ensure that you explicitly target the JMS module (JRFWSAsyncJmsModule) to non-clustered servers in your domain.

4.4.2 Configuring Custom Request and Response Queues

If the default WebLogic JMS queues do not meet your requirements, you can perform the following steps:

1.Configure the request and response queues manually, as described in Oracle Fusion Middleware Programming JMS for Oracle WebLogic Server.
2. Add them to your application code using the following annotations:
   - Request queue:
     oracle.webservices.annotations.async.AsyncWebServiceQueue
For more information, see Section A.4, "@AsyncWebServiceQueue Annotation".

- **Response queue**: oracle.webservices.annotations.async.ResponseQueue
  For more information, see Section A.5, "@AsyncWebServiceResponseQueue Annotation".

The following provides a list of best practices for configuring the request and response queues (in Step 1):

- Configure queues in a cluster for high availability and failover.
- Configure a single JMS Server and WebLogic persistence store for each WebLogic Server and target them to the server’s default migratable target.
- For the JMS Server, configure quotas, as required.
  To prevent out-of-memory errors, it is recommended that you configure the maximum messages quota for each JMS Server. As a guide, each message header consumes approximately 512 bytes. Therefore, a maximum quota of 500,000 message will require approximately 250MB of memory. Consider the memory resources available in your environment and set this quota accordingly.
- Configure a single JMS system module and target it to a cluster.
- For the JMS system module, configure the following:
  - Single subdeployment and populate it with each JMS Server.
  - Required uniform distributed destination(s) and define targets using advanced subdeployment targeting (defined above).
  - Custom connection factory. If transactions are enabled, the connection factory must support transactions, if enabled. By default, WebLogic JMS provides the weblogic.jms.XAConnectionFactory connection factory to support transactions.
- Configure retry-related parameters for the queues, as required. Note that the default is set to -1, which specifies that the retry count is unlimited.

### 4.4.3 Administering Request and Response Queues at Runtime

Using Oracle Enterprise Manager, you can modify the request and response queues at runtime. You will need to stop and restart the server in order for the updates to take effect. For complete details, see "Configuring Asynchronous Web Services" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

### 4.5 Configuring the Callback Service

You can use the annotations defined in the following table to customize characteristics for the callback service (portType). The annotations are included in the oracle.webservices.annotations.async package.
4.6 Defining Asynchronous Web Service Clients

The following two types of clients can call asynchronous Web services:

- **SOA/BPEL clients**—The process is identical to that of calling other asynchronous BPEL clients. For more information, see "Invoking an Asynchronous Web Service from a BPEL Process" in Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.

- **WebLogic Java EE (JEE) JAX-WS Clients**—Using the Create Web Service Proxy wizard in JDeveloper, select the **Generate As Async** option to generate an asynchronous proxy. For more information about creating Web service clients using the wizard, see "Creating Web Service Proxies" in the JDeveloper Online Help.

The following sections step through an example an asynchronous client and callback service that is generated and describe the updates that need to be implemented.

- **Section 4.6.1, "Updating the Asynchronous Client Code"
- **Section 4.6.2, "Updating the Callback Service Code"

---

### 4.6.1 Updating the Asynchronous Client Code

The following provides a sample of the client code that is generated to support asynchronous Web services. As shown in bold, the client code must set two fields in the outbound header to correlate the asynchronous messages:

- ReplyTo address—Address of the callback service.
- MessageID—Unique ID that identifies the request. For example, a UUID.

The client code that is generated provides a UUID for the message ID that is sufficient in most cases, though you may wish to update it. You need to update the ReplyTo address to point to the callback service.

**Example 4–1** Updating the Asynchronous Client Code

```java
package async.jrf;

import com.sun.xml.ws.api.addressing.AddressingVersion;
```
import com.sun.xml.ws.api.addressing.WSEndpointReference;
import com.sun.xml.ws.developer.WSBindingProvider;
import com.sun.xml.ws.message.StringHeader;
import java.util.UUID;
import javax.xml.ws.WebServiceRef;

// !THE CHANGES MADE TO THIS FILE WILL BE DESTROYED IF REGENERATED!
// This source file is generated by Oracle tools
// Contents may be subject to change

// For reporting problems, use the following
// Version = Oracle WebServices (11.1.1.0.0, build 090303.0200.48673)

public class HelloServicePortClient
{
    private static HelloServiceService helloServiceService;
    private static final AddressingVersion WS_ADDR_VER = AddressingVersion.W3C;

    public static void main(String [] args)
    {
        helloServiceService = new HelloServiceService();
        HelloService helloService = helloServiceService.getHelloServicePort();
        // Get the request context to set the outgoing addressing properties
        WSBindingProvider wsbp = (WSBindingProvider)helloService;
        WSEndpointReference repl
        new WSEndpointReference(
            'http://<replace with the URL of the callback service>',
            WS_ADDR_VER);
        String uuid = 'uuid:' + UUID.randomUUID();
        wsbp.setOutboundHeaders(
            new StringHeader(WS_ADDR_VER.messageIDTag, uuid),
            replyTo.createHeader(WS_ADDR_VER.replyToTag));
        // Add your code to call the desired methods.
    }
}

4.6.2 Updating the Callback Service Code

The following provides a sample of the callback service code. The code shown in bold illustrates how to extract the relatesToID from the message header, which is sent by the client as the MessageID.

You need to implement the code to process the response and deploy the callback service as a Web service. Once deployed, add the URL of the callback service to the client code as the replyTo field.

package async.jrf;

import com.sun.xml.ws.api.addressing.AddressingVersion;
import com.sun.xml.ws.api.message.Header;
import com.sun.xml.ws.api.message.HeaderList;
import com.sun.xml.ws.developer.JAXWSProperties;
import javax.annotation.Resource;
import javax.jws.Oneway;
import javax.jws.WebMethod;
import javax.jws.WebParam;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import javax.jws.soap.SOAPBinding.Style;
import javax.xml.bind.annotation.XmlSeeAlso;
import javax.xml.ws.Action;
import javax.xml.ws.RequestWrapper;
import javax.xml.ws.WebServiceContext;
import javax.xml.ws.soap.Addressing;

// !THE CHANGES MADE TO THIS FILE WILL BE DESTROYED IF REGENERATED!
// This source file is generated by Oracle tools
// Contents may be subject to change
// For reporting problems, use the following
// Version = Oracle WebServices (11.1.1.0.0, build 090303.0200.48673)

@WebService(targetNamespace="http://jrf.async/", name="HelloServiceResponse")
@XmlSeeAlso(
    { async.jrf.ObjectFactory.class })
@SOAPBinding(style=Style.DOCUMENT)
@Addressing(enabled=true, required=true)
public class HelloServiceResponseImpl
{
    @Resource
    private WebServiceContext wsContext;
    private static final AddressingVersion WS_ADDR_VER = AddressingVersion.W3C;
    @WebMethod
    @Action(input="")
    @RequestWrapper(localName="helloResponse", targetNamespace="http://jrf.async/",
        className="async.jrf.HelloResponse")
    @Oneway
    public void helloResponse(@WebParam(targetNamespace="", name="return")
        String _return)
    {
        // Use the sample code to extract the relatesTo id for correlation and then
        // add your rest of the logic
        System.out.println("Received the asynchronous reply");
        // get the messageId to correlate this reply with the original request
        HeaderList headerList = (HeaderList)wsContext.getMessageContext().
            get(JAXWSProperties.INBOUND_HEADER_LIST_PROPERTY);
        Header relatesToheader = headerList.get(WS_ADDR_VER.relatesToTag, true);
        String relatedToMessageId = relatesToheader.getStringContent();
        System.out.println("RelatesTo message id: " + relatesToMessageId);
        // Add your implementation here.
    }
}

4.7 Attaching Policies to Asynchronous Web Services and Clients

You can attach policies to the following asynchronous components:

- Client calling asynchronous Web service—See "Attaching Policies to
  Asynchronous Web Service Clients” on page 4-11.
- Asynchronous Web service—See "Attaching Policies to Asynchronous Web
  Services and Callback Services” on page 4-11.
- Asynchronous callback client—See "Attaching Policies to Callback Clients” on
  page 4-12.
- Asynchronous callback service—See "Attaching Policies to Asynchronous Web
  Services and Callback Services” on page 4-11.
The asynchronous Web service and client policies must comply with one another. Similarly, the asynchronous callback client and callback service policies must comply with one another.

You can use one of the following methods to attach policies to the components:

- Using annotations at design time.
- Using Enterprise Manager at runtime.

Each method is described in detail in the following sections.

### 4.7.1 Attaching Policies to Asynchronous Web Service Clients

At design time, you can use the following methods to attach policies:

- For SOA/BPEL clients, you can use the SOA Composite Editor to attach policies, as described in "Managing Policies" in Oracle Fusion Middleware Developer’s Guide for Oracle SOA Suite.

- For WebLogic Java EE JAX-WS Clients, you can use the Create Web Service Proxy wizard in JDeveloper to attach policies. For more information about creating Web service clients using the wizard, see "Creating Web Service Proxies" in the JDeveloper Online Help.

At runtime, you can use the Enterprise Manager to attach policies to each type of client, as described in "Attaching Policies to Web Service Clients" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

### 4.7.2 Attaching Policies to Asynchronous Web Services and Callback Services

At design time, to attach policies to an asynchronous Web services and callback services, you can use one of the annotations defined in Table 4–2. The annotations are included in the oracle.webservices.annotations package.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@AddressingPolicy</td>
<td>Attaches a WS-Addressing policy to the Web service. For more information, see Section A.2, &quot;@AddressingPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@ManagementPolicy</td>
<td>Attaches a management policy to the Web service. For more information, see Section A.13, &quot;@ManagementPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@MtomPolicy</td>
<td>Attaches an MTOM policy to the Web service. For more information, see Section A.14, &quot;@MtomPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@ReliabilityPolicy</td>
<td>Attaches a reliable messaging policy to the Web service. For more information, see Section A.16, &quot;@ReliabilityPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@SecurityPolicies</td>
<td>Specifies an array of @SecurityPolicy annotations. Use this annotation if you want to attach more than one WS-Policy files to a class. For more information, see Section A.18, &quot;@SecurityPolicies Annotation&quot;.</td>
</tr>
<tr>
<td>@SecurityPolicy</td>
<td>Attaches a security policy to the Web service. For more information, see Section A.19, &quot;@SecurityPolicy Annotation&quot;.</td>
</tr>
</tbody>
</table>

At runtime, you can use the Enterprise Manager to attach policies to asynchronous Web services and callback services, as described in "Attaching Policies to Web Services" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

Use the following guidelines when attaching message protection policies to asynchronous Web services and callback services:
■ If you want to enforce a message protection policy on the callback service, you must also enforce a message protection policy on the asynchronous request. Otherwise, an error message will be returned at runtime indicating that the asynchronous client public encryption certificate is not found.

You can enforce a message protection policy on the asynchronous request without enforcing that same policy on the callback service.

■ If you enforce a message protection policy on the asynchronous Web service, then you must configure the client public encryption certificate in the client keystore.

### 4.7.3 Attaching Policies to Callback Clients

**Note:** The policies that you attach to the callback client are advertised in the asynchronous Web service WSDL.

At design time, to attach policies to an asynchronous callback client, you can use one of the annotations defined in Table 4–3. The annotations are included in the oracle.webservices.annotations.async package.

#### Table 4–3 Annotations for Attaching Policies to Callback Clients

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@CallbackManagementPolicy</td>
<td>Attaches a Management policy to the callback client of the asynchronous Web service that will connect to the callback service. By default, no Management policy is attached. For more information, see Section A.8, &quot;@CallbackManagementPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@CallbackMtomPolicy</td>
<td>Attaches an MTOM policy to the callback client of the asynchronous Web service that will connect to the callback service. By default, no MTOM policy is attached. For more information, see Section A.9, &quot;@CallbackMtomPolicy Annotation&quot;.</td>
</tr>
<tr>
<td>@CallbackSecurityPolicy</td>
<td>Attaches one or more security policies to the callback client of the asynchronous Web service that will connect to the callback service. By default, no security policies are attached. For more information, see Section A.12, &quot;@CallbackSecurityPolicy Annotation&quot;.</td>
</tr>
</tbody>
</table>

At runtime, you can use the Enterprise Manager to attach policies to asynchronous callback clients, as described in "Attaching Policies to Asynchronous Web Service Callback Clients" in *Oracle Fusion Middleware Security and Administrator’s Guide for Web Services*. 
This section describes how to use Web Services Reliable Messaging (WS-ReliableMessaging) to exchange message reliably.

- Section 5.1, "Overview of Web Services Reliable Messaging"
- Section 5.2, "Predefined Reliable Messaging Policies"
- Section 5.3, "Attaching Reliable Messaging Policies"
- Section 5.4, "Configuring Reliable Messaging Policies"

### 5.1 Overview of Web Services Reliable Messaging

Message exchanges between Web services can be disrupted by various errors, including network, system, and software component errors or anomalies. Once a Web service or client sends a message, there is no immediate way, except by consulting network-level exceptions or SOAP fault messages, to determine whether the message was delivered successfully, if delivery failed and requires a retransmission, or if a sequence of messages arrived in the correct order.

To resolve these issues, Oracle Infrastructure Web services support the messaging protocol defined by the Web Services Reliable Messaging (WS-ReliableMessaging) specification at [http://docs.oasis-open.org/ws-rx/wsrm/200702/wsrm-1.1-spec-os-01.pdf](http://docs.oasis-open.org/ws-rx/wsrm/200702/wsrm-1.1-spec-os-01.pdf). This specification describes a protocol that makes message exchanges reliable. Reliable is defined as the ability to guarantee message delivery between the two Web Services. It ensures that messages are delivered reliably between distributed applications regardless of software component, system, or network failures. Ordered delivery is assured and automatic retransmission of failed messages does not have to be coded by each client application.

A reliable Web service provides the following delivery assurances.

<table>
<thead>
<tr>
<th>Table 5–1 Delivery Assurances for Reliable Messaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Assurance</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>At Most Once</td>
</tr>
<tr>
<td>At Least Once</td>
</tr>
<tr>
<td>Exactly Once</td>
</tr>
<tr>
<td>In Order</td>
</tr>
</tbody>
</table>
Consider using reliable messaging if your Web service is experiencing the following problems:

- Network failures or dropped connections.
- Messages are lost in transit.
- Messages are arriving at their destination out of order.

### 5.2 Predefined Reliable Messaging Policies

Reliable messaging is driven by policies and the Policy framework. As described in Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services," Oracle WSM provides a set of predefined policies that are automatically available when you install Oracle Fusion Middleware.

The reliable messaging policies listed in Table 5–2 are available out-of-the-box.

<table>
<thead>
<tr>
<th>Reliable Messaging Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>oracle/wsrm11_policy</td>
<td>Provides support for version 1.1 of the Web Services Reliable Messaging protocol.</td>
</tr>
<tr>
<td>oracle/wsrm10_policy</td>
<td>Provides support for version 1.0 of the Web Services Reliable Messaging protocol.</td>
</tr>
</tbody>
</table>

For more information about the reliable messaging predefined policies, see "Reliable Messaging Policies" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

### 5.3 Attaching Reliable Messaging Policies

You can attach reliable messaging policies to Oracle Infrastructure Web services or clients at design time using Oracle JDeveloper, or at runtime using the Oracle Enterprise Manager. For more information, see Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services."

### 5.4 Configuring Reliable Messaging Policies

You must configure the reliable messaging policies before you can use them in your environment. You need to configure the following:

- Delivery assurance (see Table 5–1)
- Message store information, such as type and name
- Retransmission interval—Interval, in milliseconds, that the source endpoint waits after transmitting a message and before it retransmits the message if it receives no acknowledgment for that message.
- Inactivity timeout—Amount of time, in milliseconds, that can elapse between message exchanges associated with a particular WS-RM sequence before the sequence is terminated.

The steps to configure reliable messaging policies are described in "Reliable Messaging Policies and Configuration Steps" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.
This chapter describes how Oracle Infrastructure Web services process messages that are encoded in Message Transmission Optimization Mechanism (MTOM) format.

- Section 6.1, "Overview of Message Transmission Optimization Mechanism"
- Section 6.2, "Predefined MTOM Attachment Policies"
- Section 6.3, "Attaching MTOM Policies"
- Section 6.4, "Configuring MTOM Policies"

6.1 Overview of Message Transmission Optimization Mechanism

Binary content, such as an image in JPEG format, can be passed between the client and the Web service. In order to be passed, the binary content is typically inserted into an XML document as an `xsd:base64Binary` string. Transmitting the binary content in this format greatly increases the size of the message sent over the wire and is expensive in terms of the required processing space and time.

Using MTOM, binary content can be sent as a MIME attachment, which reduces the transmission size on the wire. The binary content is semantically part of the XML document. This is an advantage over SWA (SOAP Messages with Attachments), in that it enables you to apply operations such as WS-Security signature on the message. For more information, refer to the following specifications:

- SOAP 1.2: [http://www.w3.org/TR/2005/REC-soap12-mtom-20050125](http://www.w3.org/TR/2005/REC-soap12-mtom-20050125)
- SOAP 1.1: [http://www.w3.org/Submission/2006/SUBM-soap11mtom10-20060405](http://www.w3.org/Submission/2006/SUBM-soap11mtom10-20060405)

Using MTOM to pass binary content as an attachment improves the performance of the Web services stack. Performance is not affected if an MTOM-encoded message does not contain binary content.

MTOM provides an optimized transmission mechanism for SOAP 1.2 messages with an envelope that contains elements of XML schema type `xs:base64` binary. MTOM makes use of data handling mechanisms described in the following specifications:

- XOP (XML-binary Optimized Packaging)—Provides a mechanism to more efficiently serialize XML Infosets that have content of type `xs:base64Binary`. The XOP specification is available at the following Web site: [http://www.w3.org/TR/xop10/](http://www.w3.org/TR/xop10/)
- DMCBDX (Describing Media Content of Binary Data in XML)—Provides content type information for the binary data in the XML instance and schema. This
information can be used to optimize the processing of binary data. The DMCBDX specification is available at the following Web site:
http://www.w3.org/TR/2005/NOTE-xml-media-types-20050504/

- RRSHB (Resource Representation SOAP Header Block)—allows a SOAP message to carry a representation of a Web resource, such as a JPEG image, in a SOAP header block. When combined with MTOM and XOP, the Web resource contained in a RRSHB SOAP header block can be transmitted as a raw binary MIME attachment instead of an xs:base64Binary string in the SOAP header. The RRSHB specification is available at the following Web site:
http://www.w3.org/TR/2005/REC-soap12-rep-20050125/

These specifications fulfill the requirements outlined in OSUCR (SOAP Optimized Serialization Use Cases and Requirements), as described at:
http://www.w3.org/TR/2004/WD-soap12-os-ucr-20040608/

### 6.2 Predefined MTOM Attachment Policies

As described in Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services," Oracle WSM provides a set of predefined policies and assertion templates that are automatically available when you install Oracle Fusion Middleware.

The MTOM attachment policies listed in Table 6–1 are available out-of-the-box.

<table>
<thead>
<tr>
<th>Reliable Messaging Policy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>oracle/wsmtom_policy</td>
<td>Rejects inbound messages that are not in MTOM format and verifies that outbound messages are in MTOM format.</td>
</tr>
</tbody>
</table>

For more information about the MTOM attachment predefined policies, see "MTOM Attachment Policies" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

### 6.3 Attaching MTOM Policies

You can attach MTOM policies to Oracle Infrastructure Web services and clients at design time using Oracle JDeveloper, or at runtime using the Oracle Enterprise Manager. For more information, see Chapter 2, "Attaching Policies to Oracle Infrastructure Web Services.”

### 6.4 Configuring MTOM Policies

No configuration steps are required.
This chapter introduces RESTful Web service concepts and describes how to develop and configure RESTful Web services.

- Section 7.1, "Overview of RESTful Web Services"
- Section 7.2, "How RESTful Web Services Requests Are Formed and Processed"
- Section 7.3, "Enabling RESTful Web Services"
- Section 7.4, "Limitations of RESTful Web Service Support"

### 7.1 Overview of RESTful Web Services

Representational State Transfer (REST) describes any simple interface that transmits data over a standardized interface (such as HTTP) without an additional messaging layer, such as SOAP. REST provides a set of design rules for creating stateless services that are viewed as resources, or sources of specific information, and can be identified by their unique URIs. A client accesses the resource using the URI, a standardized fixed set of methods, and a representation of the resource is returned. The client is said to transfer state with each new resource representation.

When using the HTTP protocol to access RESTful resources, the resource identifier is the URL of the resource and the standard operation to be performed on that resource is one of the HTTP methods: GET, PUT, DELETE, POST, or HEAD.

You build RESTful endpoints using the `invoke()` method of the `javax.xml.ws.Provider<T>` interface (see [http://java.sun.com/javaee/5/docs/api/javax/xml/ws/Provider.html](http://java.sun.com/javaee/5/docs/api/javax/xml/ws/Provider.html)). The `Provider` interface provides a dynamic alternative to building an service endpoint interface (SEI).

### 7.2 How RESTful Web Services Requests Are Formed and Processed

The following sections describe how RESTful Web service requests are formed on the client side and how they are processed on the server side.

- Section 7.2.1, "Building HTTP Get Requests"
- Section 7.2.2, "Build HTTP Post Request"
- Section 7.2.3, "Building RESTful Responses"

#### 7.2.1 Building HTTP Get Requests

If a SOAP endpoint that is REST enabled is deployed at the following URL:
http://example.com/my-app/my-service

Then HTTP GET requests will be accepted at the following URL:

http://example.com/my-app/my-service/\{operationName\}?\{param1\}={value1}&\{param2\}={value2}

In the example above, \{operationName\} specifies 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 (typically less than 2000 characters). Try to keep the size of the URL small by using a limited number of parameters and short parameter names and 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-literal, these must be simpleTypes.

The following example illustrates the request message defined for an operation named addNumbers.

**Example 7–1  GET Request on an Operation**

```xml
<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

The following example illustrates the SOAP envelope that the Oracle 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 7–2  SOAP Envelope Created from a GET Request**

```xml
<soap:Envelope>
  <soap:Body>
    <ns:addNumbers>
      <ns:a>23</ns:a>
      <ns:b>24</ns:b>
    </ns:addNumbers>
  </soap:Body>
</soap:Envelope>
```

The following example illustrates the request message sent for the addNumbers service when it is defined as a document-literal operation.

**Example 7–3  Sample GET Request on a Document-Literal Wrapped Operation**

```xml
<wsdl:message name="AddNumbersRequest">
  <wsdl:part name="params" type="tns:AddNumbersRequstObject" />
```
How RESTful Web Services Requests Are Formed and Processed

The following example illustrates the definition of the AddNumbersRequestObject as it would be defined in the schema.

**Example 7–4 XML Definition of a Document-Literal Wrapped Operation**

```xml
<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.

http://{yourhost}/{context-path}/{service-url}/addNumbers?a=23&b=24

---

**Note:** This is the same URL that is used for the RPC-literal request in Example 7–1.

### 7.2.2 Build HTTP Post Request

RESTful Web services support HTTP POST requests that are simple XML messages—not SOAP envelopes. RESTful 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 RESTful request.

When a SOAP service receives a POST request, it looks for a SOAP action 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 RESTful request.

RESTful 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 RESTful request will be wrapped in the SOAP envelope illustrated in Example 7–6.

**Example 7–5 RESTful Request**

```xml
<ns:addNumbers>
    <ns:a>23</ns:a>
    <ns:b>24</ns:b>
</ns:addNumbers>
```

The following request will be processed as a normal SOAP request.

**Example 7–6 SOAP Envelope Wrapping the RESTful Request**

```xml
<soap:Envelope>
    <soap:Body>
        <ns:addNumbers>
```
7.2.3 Building RESTful Responses

For any request (either GET or POST) that was processed as a RESTful request, the response must also be in RESTful style. The server will transform the SOAP response on the server into a RESTful response before sending it to the client. The RESTful 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 the following example exists on the server.

**Example 7–7 SOAP Response**

```xml
<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>
```

The following example 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 7–8 RESTful Response**

```xml
<ns0:result xmlns:ns0="…">
  <ns:title>How to Win at Poker</ns:title>
  <ns:author>John Doe</ns:author>
</ns0:result>
```

7.3 Enabling RESTful Web Services

When administering a Web service using the Oracle Enterprise Manager, you can enable it as a RESTful Web service by setting **REST Enabled** to **true** on the Configuration tab of the Web service endpoint page, as shown in the following figure. For more information, see "Enabling or Disabling RESTful Web Services" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.
Limitations of RESTful Web Service Support

7.4 Limitations of RESTful Web Service Support

The following list describes the limitations in Oracle Web Services support for RESTful Web services.

- RESTful Web service 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, typically to 2000 characters or less. Try to keep the size of the URL small by using a limited number of parameters and short parameter values and names.
- RESTful 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 RESTful Web services. This is because SOAP headers, which are typically used to carry this information, cannot be used with RESTful invocations of services.
- RESTful 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 RESTful Web services cannot contain multibyte characters.
This chapter provides guidelines for ensuring interoperability.

- **Section 8.1, “Introduction to Web Service Interoperability”**
- **Section 8.2, “Web Service Interoperability Organizations”**
- **Section 8.3, “General Guidelines for Creating Interoperable Web Services”**

### 8.1 Introduction to Web Service Interoperability

The goal of the Web service architecture is to allow heterogeneous business applications to smoothly work together. The architecture is loosely coupled and based on XML standards. Web services are designed to work with each other by defining Web Service Description Language (WSDL) files as service contracts, regardless of which operating system and development technology are behind them. However, because of the complexity involved in service contracts, standards like WSDL and SOAP leave room for ambiguous interpretations. In addition, vendor-specific enhancements and extensions work against universal interoperability.

Business applications must invoke each other’s services. These services are often implemented with different technologies. Interoperability failures tend to increase as Web service complexity increases. If you host a publicly available Web service, you will want to ensure that your clients from all over the world, using vastly different tool kits, can successfully invoke it. Likewise, your business application might need to integrate or interact with another vendor’s Web service that was built on top of an existing legacy system and has an unusual interface design.

Interoperability issues can originate from any layer of the protocol stack. On the transport level, both parties involved in exchanging messages must agree on a specific physical transport mechanism. For example, you cannot expect to use JMS transport from a non-Java platform. This is why using basic HTTP protocol increases your chance of interoperability. On the message level, because SOAP allows virtually any type of data encoding to be used, interoperability can become difficult. For example, a standard ArrayList on a Java platform will not be automatically translated into a System.collections.ArrayList on the .NET platform. Also, interoperability issues arise at the basic WSDL and SOAP level—advanced Web service developers will find many more new challenges when they start implementing quality of service (QOS) features such as security, reliability, and transaction services.

Difficulties in interoperability do exist. However, with a few good guidelines, your Oracle Infrastructure Web service should work seamlessly with other Java EE vendor platforms or non-Java platforms like the Microsoft .NET platform.
8.2 Web Service Interoperability Organizations

As interoperability gains more and more importance in the Web service community, a number of organizations have been established to achieve this goal.

8.2.1 SOAPBuilders Community

SOAPBuilders is a loosely organized forum of developers working towards a set of tests for interoperability between SOAP implementations. Interoperability is demonstrated by implementing a canonical set of tests that are collectively defined by the participants in the forum.

The tests developed by the SOAPBuilder community are, by and large, based on vendor practices. However, practices shift over time. Clean and well-defined rules organized in a formal manner are needed for Web service vendors, Web service developers, and Web service consumers. See the following Web site for more information on SOAPBuilder tests: http://www.whitemesa.net/

8.2.2 WS-Interoperability

The Web Services Interoperability organization (WS-I) is an open industry organization that creates, promotes, and supports generic protocols for the interoperable exchange of messages between Web services. WS-I profiles are guidelines and recommendations for how the standards should be used. These profiles aim to remove ambiguities by adding constraints to the underlying specifications.

WS-I deliverables are profiles, common or best practices, scenarios, testing software, and testing materials. You should design your Web service so that it adheres to WS-I basic profiles. WS-I compliant services agree to clear contracts and have a greater chance of interoperability.

For example, a WS-I basic profile-compliant Web service should use the following features.

- Use HTTP or HTTPS as the transport binding. HTTP 1.1 is preferred over HTTP 1.0.
- Use literal style encoding. Do not use SOAP encoding.
- Use stricter fault message syntax. When a MESSAGE contains a soap:Fault element, its element children must be unqualified.
- Use XML version 1.0.
- The service should not declare array wrapper elements using the convention ArrayOfXXX.

The WS-I Web site provides more information about WS-I profiles, and the rules defined within profiles: http://www.ws-i.org/

Oracle is a member of the WS-I organization and is fully committed to helping our customers achieve interoperability. The Oracle Infrastructure Web Services platform allows a high degree of flexibility to help you create interoperable Web services.

Oracle JDeveloper supports integrated testing of WSDL files and running Web services for WS-I Basic Profile conformance. It delivers an enhanced HTTP Analyzer for monitoring and logging, and provides a built-in analysis and reporting tool to better diagnose interoperability issues. For more information, see the Oracle JDeveloper online help.
8.3 General Guidelines for Creating Interoperable Web Services

The first general guideline is to create Web services which are WS-I compliant, if possible. The WS-I profiles, however, do not solve all interoperability problems. Many Web services were implemented before WS-I profiles existed. Also, the legacy systems that you are enabling as a Web service might have placed restrictions on your designs. Thus, good practice in designing Web services should always be adopted from the beginning of the development process, whenever possible.

The following sections provide general guidelines for creating interoperable Web services.

8.3.1 Design Your Web Service Top Down

The top-down from WSDL approach enables you to design your Web service from service contracts that are not tied to any platform or language-specific characteristics. Contract-level interoperability can be ensured even before your Web service is implemented. Other Web service platform tools will be able to process your WSDL file and it is less likely that the service will be affected by existing legacy APIs.

8.3.2 Design Your Data Types Using XSD First

If possible, use an XSD schema editor to design your data types with schema types. Resist using platform-specific data types such as the .NET DataSet data type, Java collections, and so on.

8.3.3 Keep Data Types Simple

Avoid unnecessarily complex schema data types such as `xsd:choice`. Simple types provide the best interoperability and have the added benefit of improved performance.

8.3.3.1 Use Single-dimensional Arrays

Use single dimensional arrays, if possible. Use arrays of arrays instead of multi-dimensional arrays.

Multi-dimensional arrays (applicable in RPC-encoded formats only) are not supported on the .NET platform. Also, in the case of multi-dimensional arrays, the length of the inner arrays must be the same. Arrays of arrays provides flexibility in such a way that the length of contained arrays can be different.

**Note:** While XSD supports the definition of multi-dimensional arrays in the WSDL, programming languages such as Java map them to arrays of arrays and express the payload in a multi-dimensional format. While converting the payload to multi-dimensional format, the Java VM must ensure that the length of each inner array is the same, as well as perform other checks.

8.3.3.2 Differentiate Between Empty Arrays and Null References to Arrays

If you have an array with attributes `minoccurs=0` and `xsd:nillable=true`, for example, and the service implementation attempts to return a null reference to this array, then the representation of the payload becomes problematic. Some implementations can completely ignore this element in the payload as `minoccurs=0`,
while other implementations can specify this in the payload with the attribute xsi:nil=true.

The same question arises when you attempt to deserialize the array. You can deserialize either to a null reference or to an array that contains no element. In this case, the guideline is to check for null always before checking for length.

### 8.3.3.3 Avoid Sparse, Variable-sized, or Multi-dimensional Arrays

Although sparse, variable-sized, and multi-dimensional arrays are supported by XSD, they may not be supported by your target platform. If you are creating your Web service top down from WSDL, try to avoid these array types and use regular arrays.

### 8.3.3.4 Avoid Using xsd:anyType

Typically, xsd:anyType is mapped to java.lang.Object in the Java platform; this allows you to pass any run-time that will require a separate serializer and de-serializers to be registered. The guideline is to find all the possible types that can be used in the runtime and define them in the WSDL.

The following example illustrates a class MyAnyType and two classes, MyPossibleType1 and MyPossibleType2, that extend it. In this case, use MyAnyType instead of xsd:anyType, in the Web method.

#### Example 8–1 Classes with Member Variables

```java
public class MyAnyType {
    //No member variable
}

public class MyPossibleType1 extends MyAnyType {
    //member variable.
}

public class MyPossibleType2 extends MyAnyType {
    //member variable
}
```

### 8.3.3.5 Map Any Unsupported xsd:types to SOAPElement

It is possible for the presence of only one unsupported xsd:type in the WSDL to affect interoperability. The easy work around is to map the unsupported XSD type to SOAPElement by using a mapping mechanism, such as a JAX-RPC mapping file. Even if you have a type that is supported but fails during runtime, you can still attempt to map it to SOAPElement, then parse the SOAPElement inside the client or server.

### 8.3.4 Use Null Values With Care

Decide what you want to do with null values. For example, should an array be allowed to be null? Should you use a null string or an empty string? If you are sending a null value across platforms, will it cause exceptions on the receiver side?

Avoid sending null values if possible. If you must use null values in your application, design your schema types to clearly indicate that a null value is allowed.
8.3.5 Use a Compliance Testing Tool to Validate the WSDL

If your Web service is designed to be WS-I compliant, use the WS-I monitor tool to log messages and the analyzer tool to validate for conformance. You can obtain free downloads of WS-I tools from the following Web site:


8.3.6 Consider the Differences Between Platform Native Types

Some schema types, such as `xsd:unsignedshort` and `xsd:unsignedint`, do not always have a direct native type mapping. For example, there are no Java platform equivalent unsigned types. Schema numeric types such as `xsd:double`, `xsd:float`, and `xsd:decimal` might have different precisions once mapped to their platform native types.

There are also limitations on the `xsd:string` type. The strings must not contain illegal XML characters and the \r (carriage return) character will typically be mapped to the \n (line feed) character.

Use `byte[]` instead of `xsd:string` when you do not know the character set that the source data uses. Binary content is more interoperable than text content.

If you are creating the Web service bottom up from Java classes, you must ensure that you use the closest possible data type. Thus, use Java data types closer to the `xsd:type`. For example, if you want to use `xsd:dateTime` to represent a date and time, then use the `javax.xml.datatype.XMLGregorianCalendar` data type instead of `java.lang.Data` or `java.util.Calendar`. The `XMLGregorianCalendar` data type can return a more precise time because it can store fractional seconds.

If you are creating the Web service top down from WSDL, use mapping files to map the `xsd:dateTime` to `XMLGregorianCalendar` if time accuracy is very important.

---

**Note:** All of the pre-Java EE platforms, such as J2EE 1.*, used Calendar, but now Java EE-compliant platforms use `XMLGregorianCalendar`. This provides better .Net interoperability because it can handle long fractions of seconds.

---

8.3.7 Avoid Using RPC-Encoded Message Format

By itself, the RPC-encoded message format does not imply that you will not be able to interoperate with other platforms and clients. In many cases, there are RPC-encoded Web services which are in use today. The reason to move away from RPC-encoded message formats is to avoid some of the edge cases where different interpretations of the underlying specification and implementation choices break interoperability. Some examples include the treatment of sparse arrays, multi-dimensional arrays, custom fault code QNames, un-typed payloads, and so on.

8.3.8 Avoid Name Collisions

If you are creating Web services bottom up from Java classes, you can avoid name collisions by using explicit package names in your classes. If you are creating Web services top down from WSDL, you can avoid name collisions by using unique namespace URIs.
8.3.9 Use Message Handlers, Custom Serializers, or Interceptors

You can use message handlers, custom serializers, or interceptors to easily fix some interoperability issues. This idea is to fix the issue on the payload at a very granular level, by intercepting and changing the message either before it encounters the de-serializers, or after the payload is generated by the serializers and before it is put on the wire.

8.3.10 Apply WS-* Specifications Judiciously

Many WS-* specifications are in early adoption phase, and could potentially reveal interoperability issues with different stacks. A suggestion would be to make sure that a WS-* feature is absolutely required before applying it. Another suggestion would be to apply features that are most commonly used in the Web services space. For example, if you are in a situation where there are several possible options, such as choosing either Basic Authentication, X.509, or Kerberos for security, then choose the option which is most commonly used in the Web services space.

---

**Note:** By default, when most Web service assembly tools use the top down approach, they will try to derive a package name for the generated classes from the namespace URI. When they use the bottom up approach, they will try to use the Java package name to derive a namespace URI.

Unfortunately, because of valid package name limitations, this derivation is not 1-1. So, specifying namespace URI in such a way that it does not produce a conflicting package name that another namespace URI has yielded, is very important.
This appendix describes the asynchronous Web service and policy annotations that are used by Oracle Infrastructure Web services.

- Section A.1, "Overview of Annotations"
- Section A.2, "@AddressingPolicy Annotation"
- Section A.3, "@AsyncWebService Annotation"
- Section A.4, "@AsyncWebServiceQueue Annotation"
- Section A.5, "@AsyncWebServiceResponseQueue Annotation"
- Section A.6, "@CallbackAddressingPolicy Annotation"
- Section A.7, "@CallbackMethod Annotation"
- Section A.8, "@CallbackManagementPolicy Annotation"
- Section A.9, "@CallbackMtomPolicy Annotation"
- Section A.10, "@CallbackProperties Annotation"
- Section A.11, "@CallbackProperty Annotation"
- Section A.12, "@CallbackSecurityPolicy Annotation"
- Section A.13, "@ManagementPolicy Annotation"
- Section A.14, "@MtomPolicy Annotation"
- Section A.15, "@PortableWebService Annotation"
- Section A.16, "@ReliabilityPolicy Annotation"
- Section A.17, "@ResponseWebService Annotation"
- Section A.18, "@SecurityPolicies Annotation"
- Section A.19, "@SecurityPolicy Annotation"

### A.1 Overview of Annotations

The WebLogic Web Services programming model uses the JDK 5.0 metadata annotations at [http://java.sun.com/j2se/1.5.0/docs/relnotes/features.html#annotations](http://java.sun.com/j2se/1.5.0/docs/relnotes/features.html#annotations) feature (specified by JSR-175 at [http://www.jcp.org/en/jsr/detail?id=175](http://www.jcp.org/en/jsr/detail?id=175)). In this programming model, you create an annotated Java file to specify the shape and characteristics of the Web service.
Table A–1 summarizes the asynchronous Web service and policy annotations described in this appendix.

For more information about the annotations available, see Oracle Fusion Middleware Java API Reference for Oracle Web Services. For more information about the predefined policies, see "Predefined Polices" in Oracle Fusion Middleware Security and Administrator’s Guide for Web Services.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A.2, &quot;@AddressingPolicy Annotation&quot;</td>
<td>Attaches a WS-Addressing policy to the Web service.</td>
</tr>
<tr>
<td>Section A.3, &quot;@AsyncWebService Annotation&quot;</td>
<td>Declares a Web service to be an asynchronous Web service.</td>
</tr>
<tr>
<td>Section A.4, &quot;@AsyncWebServiceQueue Annotation&quot;</td>
<td>Specifies the details of a queue used for saving the request for later processing.</td>
</tr>
<tr>
<td>Section A.5, &quot;@AsyncWebServiceResponseQueue Annotation&quot;</td>
<td>Defines the queue used to save the response for later processing.</td>
</tr>
<tr>
<td>Section A.6, &quot;@CallbackAddressingPolicy Annotation&quot;</td>
<td>Not used in this release.</td>
</tr>
<tr>
<td>Section A.7, &quot;@CallbackMethod Annotation&quot;</td>
<td>Enables you to customize the names of the WSDL entities for the corresponding operation in the callback portType and set whether a method is synchronous or asynchronous.</td>
</tr>
<tr>
<td>Section A.8, &quot;@CallbackManagementPolicy Annotation&quot;</td>
<td>Attaches a management policy to the callback client of the asynchronous Web service that will connect to the callback service.</td>
</tr>
<tr>
<td>Section A.9, &quot;@CallbackMtomPolicy Annotation&quot;</td>
<td>Attaches an MTOM policy to the callback client of the asynchronous Web service that will connect to the callback service.</td>
</tr>
<tr>
<td>Section A.10, &quot;@CallbackProperties Annotation&quot;</td>
<td>Enables you to specify properties that are required in the message context when calling the callback service.</td>
</tr>
<tr>
<td>Section A.11, &quot;@CallbackProperty Annotation&quot;</td>
<td>Enables you to specify properties that are required in the message context when calling the callback service.</td>
</tr>
<tr>
<td>Section A.12, &quot;@CallbackSecurityPolicy Annotation&quot;</td>
<td>Attaches one or more security polices to the callback client of the asynchronous Web service that will connect to the callback service.</td>
</tr>
<tr>
<td>Section A.13, &quot;@ManagementPolicy Annotation&quot;</td>
<td>Attaches a management policy to the Web service.</td>
</tr>
<tr>
<td>Section A.14, &quot;@MtomPolicy Annotation&quot;</td>
<td>Attaches an MTOM policy to the Web service.</td>
</tr>
<tr>
<td>Section A.15, &quot;@PortableWebService Annotation&quot;</td>
<td>Specifies, at the class level, that the JWS file implements an Oracle Infrastructure Web service.</td>
</tr>
<tr>
<td>Section A.16, &quot;@ReliabilityPolicy Annotation&quot;</td>
<td>Attaches a reliable messaging policy to the Web service.</td>
</tr>
</tbody>
</table>
The oracle.webservices.annotations.AddressingPolicy annotation attaches a WS-Addressing policy to the Web service. For example:

```java
@AddressingPolicy(
    value="oracle/wsaddr_policy",
    enabled = "true")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.AddressingPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the location from which to retrieve the WS-Policy file. Use the http: prefix to specify the URL of a WS-Policy file on the Web. Use the policy: prefix to specify that the WS-Policy file is packaged in the policy repository.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Boolean value that specifies whether or not the policy is enabled.</td>
<td>true</td>
</tr>
</tbody>
</table>

The oracle.webservices.annotations.async.AsyncWebService annotation declares a Web service to be an asynchronous Web service.

By default, all operations associated with the Web service are asynchronous. To mark a specific method as synchronous, see Section A.7, "@CallbackMethod Annotation". If you want to be able to call a method both synchronously and asynchronously, you will have to create two methods and annotate them accordingly.

For example:

```java
@PortableWebService
@AsyncWebService
public class HelloService {
    public String hello(String name) {
        return "Hi " + name;
    }
}
```
A.4 @AsyncWebServiceQueue Annotation

The oracle.webservices.annotations.async.AsyncWebServiceQueue annotation defines the queue used to save the request for later processing. For more information, see Section 4.4, "Configuring the Request and Response Queues."

For example:

```java
@AsyncWebServiceQueue {
    connectionFactory = "weblogic.jms.XAConnectionFactory",
    queue = "oracle.j2ee.ws.server.async.NonDefaultRequestQueue",
    enableTransaction = true
}
```

The following table defines the attributes that can be passed to the `oracle.webservices.annotations.async.AsyncWebServiceQueue` annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>connectionFactory</td>
<td>Name of the JMS Queue Connection Factory for the request queue.</td>
<td><code>weblogic.jmx.XAConnectionFactory</code></td>
</tr>
<tr>
<td>queue</td>
<td>Name of the JMS queue used to store asynchronous requests.</td>
<td><code>oracle.j2ee.ws.server.async.DefaultRequestQueue</code></td>
</tr>
<tr>
<td>enableTransaction</td>
<td>Flag that specifies whether the MDB should process the asynchronous request as a transaction.</td>
<td>false</td>
</tr>
</tbody>
</table>

**Note:** A user transaction is maintained separately from the MDB transaction so that they can be committed or rolled back independently.

A.5 @AsyncWebServiceResponseQueue Annotation

The oracle.webservices.annotations.async.AsyncWebServiceResponseQueue annotation defines the queue used to save the response for later processing.

For example:

```java
@AsyncWebServiceQueue {
    connectionFactory = "weblogic.jms.XAConnectionFactory",
    queue = "oracle.j2ee.ws.server.async.NonDefaultResponseQueue",
    enableTransaction = true
}
```

The following table defines the attributes that can be passed to the `oracle.webservices.annotations.async.AsyncWebServiceResponseQueue` annotation.
The oracle.webservices.annotations.async.CallbackAddressingPolicy annotation is not used in this release as WS-Addressing is used by default to correlate the response message with the callback service. In the future, it may be used to advertise the policy to the callback exchange.

A.7 @CallbackMethod Annotation

The oracle.webservices.annotations.async.CallbackMethod annotation enables you to customize the names of the WSDL entities for the corresponding operation in the callback portType and set whether a method is synchronous or asynchronous. This annotation is similar to the javax.jws.WebMethod annotation.

For example:

```
@CallbackMethod(exclude=true)
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackMethod annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Name of the callback method in the callback portType that corresponds to the annotated method. This annotation is ignored at runtime; it is only used when generating a callback interface from a POJO implementation class.</td>
<td>&quot;onResult&quot; + &lt;name of the annotated method&gt;</td>
</tr>
<tr>
<td>operationName</td>
<td>Name of the wsdl:operation for this method in the callback portType.</td>
<td>&quot;onResult&quot; + &lt;name of the annotated method&gt;</td>
</tr>
</tbody>
</table>
The oracle.webservices.annotations.async.CallbackManagementPolicy annotation attaches a management policy to the callback client of the asynchronous Web service that will connect to the callback service. By default, no management policy is attached.

For example:

```java
@CallbackManagementPolicy("oracle/log_policy")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackManagementPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String value that specifies the URI of a management policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Flag that specifies whether the specified security policies are enabled for the callback client.</td>
<td>true</td>
</tr>
</tbody>
</table>

The oracle.webservices.annotations.async.CallbackMtomPolicy annotation attaches an MTOM policy to the callback client of the asynchronous Web service that will connect to the callback service. By default, no MTOM policy is attached.

For example:

```java
@CallbackMtomPolicy("oracle/wmmtom_policy")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackMtomPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String value that specifies the URI of a management policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Flag that specifies whether the specified security policies are enabled for the callback client.</td>
<td>true</td>
</tr>
</tbody>
</table>
A.10 @CallbackProperties Annotation

The oracle.webservices.annotations.async.CallbackProperties annotation enables you to specify a set of properties that are required in the message context when calling the callback service.

For example:

```java
@CallbackProperties(
    {
        @Property(
            name = SecurityConstants.ClientConstants.WSS_CSF_KEY,
            value = "basic.credentials")
    }
)
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackProperties annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String value that specifies the URI of an MTOM policy.</td>
<td></td>
</tr>
<tr>
<td>enabled</td>
<td>Flag that specifies whether the specified security policies are enabled for the callback client.</td>
<td>true</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>key</td>
<td>String type value that specifies the message context property name.</td>
<td></td>
</tr>
<tr>
<td>value</td>
<td>String type value that specifies the message context property value.</td>
<td></td>
</tr>
</tbody>
</table>

A.11 @CallbackProperty Annotation

The oracle.webservices.annotations.async.CallbackProperty annotation enables you to specify a single property that is required in the message context when calling the callback service.

For example:

```java
@Property(
    name = SecurityConstants.ClientConstants.WSS_CSF_KEY,
    value = "basic.credentials")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackProperty annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>key</td>
<td>String type value that specifies the message context property name.</td>
<td></td>
</tr>
<tr>
<td>value</td>
<td>String type value that specifies the message context property value.</td>
<td></td>
</tr>
</tbody>
</table>
A.12 @CallbackSecurityPolicy Annotation

The oracle.webservices.annotations.async.CallbackSecurityPolicy annotation attaches one or more security policies to the callback client of the asynchronous Web service that will connect to the callback service. By default, no security policies are attached.

For example:

```
@CallbackSecurityPolicy("oracle/wss10_saml_token_with_message_protection_client_policy")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.async.CallbackSecurityPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Array of String type values that specifies the URL of a client-side security policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Flag that specifies whether the specified security policies are enabled for the callback client.</td>
<td>true</td>
</tr>
</tbody>
</table>

A.13 @ManagementPolicy Annotation

The oracle.webservices.annotations.ManagementPolicy annotation attaches a management policy to the Web service.

For example:

```
@ManagementPolicy(
    value="oracle/log_policy",
    enabled = "true")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.ManagementPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String type value that specifies the management policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Boolean value that specifies whether or not the policy is enabled.</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>

A.14 @MtomPolicy Annotation

The oracle.webservices.annotations.MtomPolicy annotation attaches an MTOM policy to the Web service.

For example:

```
@MtomPolicy(
    value="oracle/wsmtom_policy",
    enabled = "true")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.MtomPolicy annotation.
The oracle.webservices.annotations.PortableWebService annotation specifies, at the class level, that the JWS file implements an Oracle Infrastructure Web service.

For example:

```java
@PortableWebService
@AsyncWebService
public class HelloService {
    public String hello(String name) {
        return "Hi " + name;
    }
}
```

The following table defines the attributes that are passed to the oracle.webservices.annotations.PortableWebServices annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String type value that specifies the MTOM policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Boolean value that specifies whether or not the policy is enabled.</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>

### Table A–13 Attributes for oracle.webservices.annotations.PortableWebServiceAnnotation

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>endpointInterface</td>
<td>Name of the service endpoint interface defining the service’s abstract Web service contract. This annotation allows you to separate the interface contract from the implementation. If this annotation is present, the service endpoint interface is used to determine the abstract WSDL contract (portType and bindings). The service endpoint interface can include JSR-181 annotations to customize the mapping from Java to WSDL. The service implementation may implement the service endpoint interface, but this is not required. If this attribute is not specified, the Web service contract is generated from the annotations defined for the service implementation. If a service endpoint interface is required by the target environment, it will be generated into an implementation-defined package with an implementation-defined name. <strong>Note:</strong> This attribute is invalid when annotating an endpoint interface.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>name</td>
<td>Name of the Web service. This name is used for the wsd1:portType when mapped to WSDL 1.1.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>portName</td>
<td>Port name of the Web service. This name is used for the wsd1:port when mapped to WSDL 1.1. <strong>Note:</strong> This attribute is invalid when annotating an endpoint interface.</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>
The oracle.webservices.annotations.ReliabilityPolicy annotation attaches a reliable messaging policy to the Web service.

For example:

```java
@MtomPolicy(
    value="oracle/wsrm11_policy",
    enabled = "true")
```

The following table defines the attributes that can be passed to the oracle.webservices.annotations.ReliabilityPolicy annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>String type value that specifies the reliable messaging policy.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Boolean value that specifies whether or not the policy is enabled.</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>
A.17 @ResponseWebService Annotation

The oracle.webservices.annotations.async.ResponseWebService annotation enables you to customize the response Web service port information.

The following table defines the attributes that are passed to the oracle.webservices.annotations.async.ResponseWebService annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Name of the response portType. Used as the name of the wsdl:portType when mapped to WSDL 1.1.</td>
<td>&lt;name of the annotated class&gt; + &quot;Response&quot;</td>
</tr>
<tr>
<td>targetNamespace</td>
<td>Target namespace used for the wsdl:portType, wsdl:service, and all associated elements.</td>
<td>Same as the asynchronous Web service target namespace</td>
</tr>
<tr>
<td>partnerLinkRole</td>
<td>Role name of the callback portType used in the partner link element of the WSDL.</td>
<td>N/A</td>
</tr>
<tr>
<td>serviceRefName</td>
<td>Service reference name used for the service reference that is used to send the response message. This value must be unique for the deployed archive and is used to define:</td>
<td>&lt;name of the annotated class&gt; + &quot;ResponseWebService.SERVICE_REF_NAME_SUFFIX&quot;</td>
</tr>
<tr>
<td>serviceName</td>
<td>Not used in this release.</td>
<td>N/A</td>
</tr>
<tr>
<td>portName</td>
<td>Not used in this release.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

A.18 @SecurityPolicies Annotation

The oracle.webservices.annotations.SecurityPolicies annotation specifies an array of @SecurityPolicy annotations. Use this annotation if you want to attach more than one WS-Policy files to a class.

For example:

```java
@SecurityPolicies({
    @SecurityPolicy[value=
            "policy:oracle/wss10_username_token_with_message_protection_server_policy"],
    @SecurityPolicy[value=
            "policy:oracle/authorization_policy"]})
```

A.19 @SecurityPolicy Annotation

The oracle.webservices.annotations.SecurityPolicy annotation attaches a security policy to the request or response SOAP message. This annotation can be used on its own to apply a single WS-Policy file to a class. If you want to apply more than one WS-Policy file to a class, use the @SecurityPolicies annotation to group them together.

For example:

```java
@SecurityPolicy[value=
```
The following table summarizes the attributes that you can pass to the `oracle.webservices.annotations.SecurityPolicy` annotation.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Location from which to retrieve the WS-Policy file. Use the <code>http:</code> prefix to specify the URL of a WS-Policy file on the Web. Use the <code>policy:</code> prefix to specify that the WS-Policy file is packaged in the policy repository.</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>enabled</td>
<td>Optional. Boolean value that specifies whether the policy is enabled.</td>
<td>true</td>
</tr>
<tr>
<td>Properties</td>
<td>Optional. Array of property value-name pairs.</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>