Oracle9*i*AS Containers for J2EE

JSP Tag Libraries and Utilities Reference

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Oracle9*i*AS Containers for J2EE JSP Tag Libraries and Utilities Reference, Release 2 (9.0.3)

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Contents

5 XML and XSL Tag Support

6 JESI Tags for Edge Side Includes

7 Web Object Cache Tags and API

8 JSP Utilities and Utility Tags

9 Oracle9*i*AS Personalization Tags

10 Web Services Tags

A JML Compile-Time Syntax and Tags

B Third Party Licenses

Index

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Preface

This document provides reference information as well as some conceptual material for JSP tag libraries and utilities included with OC4J. These libraries generally conform to the JSP specification.

This preface contains these topics:

Note: The Sample Applications chapter available in previous releases has been removed. Applications that were listed there are available in the OC4J demos, from either of the following locations:

- the OC4J demo instance, included with the Oracle9*i*AS product
- the JSP download page on the Oracle Technology Network (requiring an OTN membership, which is free of charge):

  `http://otn.oracle.com/tech/java/servlets/content.html`

Intended Audience

This document is intended for Web application developers using servlet and JavaServer Pages technology. It assumes that working Web, servlet, and JSP environments already exist, and that readers are already familiar with the following:

- general Web technology
- Java
- HTML
- Java servlets
- JavaServer Pages
- configuration of their Web server and servlet environments
- Oracle JDBC (for JSP applications accessing an Oracle database)
- Oracle SQLJ (for JSP database applications using SQLJ)

You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for background information about standard JavaServer Pages technology and tag library support, and details of the Oracle JSP implementation.

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Accessibility of Code Examples in Documentation JAWS, a Windows screen reader, 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, JAWS may not always read a line of text that consists solely of a bracket or brace.

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Organization

This document contains:

Chapter 1, "Overview of Tag Libraries and Utilities"

This chapter provides an overview of the tag libraries documented in the remainder of the manual, as well as overviews of tag libraries provided with other Oracle9*i*AS components (outside of OC4J).

Chapter 2, "JavaBeans for Extended Types"

This chapter discusses JavaBeans provided with the JSP Markup Language (JML) library that can be used as extended Java types.

Chapter 3, "JSP Markup Language Tags"

This provides JML syntax and tag descriptions, as well as an overview of the philosophy behind the JML tag library.

Chapter 4, "Data-Access JavaBeans and Tags"

This documents JavaBeans and tags for database access.

Chapter 5, "XML and XSL Tag Support"

This chapter describes tags to use in handling XML documents and outputting or transforming their data.

Chapter 6, "JESI Tags for Edge Side Includes"

This chapter describes the Oracle implementation of JESI tags to support Edge Side Includes technology for Web caching.

Chapter 7, "Web Object Cache Tags and API"

This describes concepts, custom tags, servlet APIs, and XML descriptor files for the Web Object Cache, an application-level Java caching interface provided with OC4J.

Chapter 8, "JSP Utilities and Utility Tags"

This chapter discusses miscellaneous utility features included with OC4J: `JspScopeListener` for event-handling; a tag and JavaBean for sending e-mail; tags and JavaBeans for uploading or downloading files; tags for using EJBs; and general utility tags.

Chapter 9, "Oracle9iAS Personalization Tags"

This chapter describes a set of tags to support use of Oracle9*i*AS Personalization. Personalization is a mechanism to tailor recommendations to application users, based on behavioral, purchasing, rating, and demographic data.

Chapter 10, "Web Services Tags"

This chapter describes the Web services tag library, which allows developers to create JSP pages for use as client programs for Web services.

Appendix A, "JML Compile-Time Syntax and Tags"

This chapter provides an overview of the compile-time implementation of the Oracle JML sample tag library (the only way the library was supported in pre-JSP 1.1 releases), and documents tags not supported in the runtime implementation that is documented in Chapter 3.

Appendix B, "Third Party Licenses"

This appendix includes the Third Party License for third party products included with Oracle9*i* Application Server and discussed in this document.

Related Documentation

See the following additional OC4J documents available from the Oracle Java Platform group:

- *Oracle9iAS Containers for J2EE User's Guide*

  This book provides some overview and general information for OC4J; primer chapters for servlets, JSP pages, and EJBs; and general configuration and deployment instructions.

- *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*

  This book provides information for JSP developers who want to run their pages in OC4J. It includes a general overview of JSP standards and programming considerations, as well as discussion of Oracle value-added features and steps for getting started in the OC4J environment.

- *Oracle9iAS Containers for J2EE Servlet Developer's Guide*

  This book provides information for servlet developers regarding use of servlets and the servlet container in OC4J. It also documents relevant OC4J configuration files.

- *Oracle9iAS Containers for J2EE Services Guide*

  This book provides information about standards-based Java services supplied with OC4J, such as JTA, JNDI, JMS, JAAS/JAZN, and the Oracle9*i* Application Server Java Object Cache.

- *Oracle9iAS Containers for J2EE Enterprise JavaBeans Developer's Guide and Reference*

  This book discusses the EJB implementation and EJB container in OC4J.

Also available from the Oracle Java Platform group:

- *Oracle9i JDBC Developer's Guide and Reference*
- *Oracle9i SQLJ Developer's Guide and Reference*
- *Oracle9i JPublisher User's Guide*
- *Oracle9i Java Stored Procedures Developer's Guide*

The following documents are available from the Oracle9*i* Application Server group:

- *Oracle9i Application Server Administrator's Guide*
- *Oracle Enterprise Manager Administrator's Guide*
- *Oracle HTTP Server Administration Guide*
- *Oracle9i Application Server Performance Guide*
- *Oracle9i Application Server Globalization Support Guide*
- *Oracle9iAS Web Cache Administration and Deployment Guide*
- *Oracle9iAS Web Services Developer's Guide*
- *Oracle9i Application Server Migrating to Release 2 (9.0.3)*

The following are available from the JDeveloper group:

- Oracle JDeveloper online help
- Oracle JDeveloper documentation on the Oracle Technology Network:

  `http://otn.oracle.com/products/jdev/content.html`

The following documents from the Oracle Server Technologies group may also contain information of interest:

- *Oracle9i XML Developer's Kits Guide - XDK*
- *Oracle9i Application Developer's Guide - Fundamentals*
- *Oracle9i Supplied Java Packages Reference*
- *Oracle9i Supplied PL/SQL Packages and Types Reference*
- *PL/SQL User's Guide and Reference*
- *Oracle9i SQL Reference*
- *Oracle9i Net Services Administrator's Guide*
- *Oracle Advanced Security Administrator's Guide*
- *Oracle9i Database Reference*
- *Oracle9i Database Error Messages*

For information about Oracle9*i*AS Personalization, which is the foundation of the Personalization tag library, you can refer to the following documents from the Oracle9*i*AS Personalization group:

- *Oracle9iAS Personalization Administrator's Guide*
- *Oracle9iAS Personalization Programmer's Guide*

In North America, printed documentation is available for sale in the Oracle Store at

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

Customers in Europe, the Middle East, and Africa (EMEA) can purchase documentation from

`http://www.oraclebookshop.com/`

Other customers can contact their Oracle representative to purchase printed documentation.

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN). You must register online before using OTN; registration is free and can be done at

`http://otn.oracle.com/`

If you already have a user name and password for OTN, then you can go directly to the documentation section of the OTN Web site at

`http://otn.oracle.com/docs/index.htm`

To access the documentation search engine directly, please visit

`http://tahiti.oracle.com`

The following Oracle Technology Network (OTN) resources are available for further information about JavaServer Pages.

- OTN Web site for Java servlets and JavaServer Pages:

  `http://otn.oracle.com/tech/java/servlets/`

- OTN JSP discussion forums, accessible through the following address:

  `http://www.oracle.com/forums/forum.jsp?id=399160`

The following resources are available from Sun Microsystems.

- Web site for JavaServer Pages, including the latest specifications:

  `http://java.sun.com/products/jsp/index.html`

- Web site for Java Servlet technology, including the latest specifications:

  `http://java.sun.com/products/servlet/index.html`

- `jsp-interest` discussion group for JavaServer Pages

  To subscribe, send an e-mail to `listserv@java.sun.com` with the following line in the body of the message:

  `subscribe jsp-interest` *`yourlastname yourfirstname`*

  It is recommended, however, that you request only the daily digest of the posted e-mails. To do this add the following line to the message body as well:

  `set jsp-interest digest`

Conventions

This section describes the conventions used in the text and code examples of this document. It describes:

- Conventions in Text
- Conventions in Code Examples

Conventions in Text

We use various conventions in text to help you more quickly identify special terms. The following table describes those conventions and provides examples of their use.

Convention	Meaning	Example
Italics	Italic typeface indicates book titles or emphasis, or terms that are defined in the text.	*Oracle9i Database Concepts* Ensure that the recovery catalog and target database do *not* reside on the same disk.
`UPPERCASE monospace (fixed-width) font`	Uppercase monospace typeface indicates elements supplied by the system. Such elements include parameters, privileges, datatypes, RMAN keywords, SQL keywords, SQL*Plus or utility commands, packages and methods, as well as system-supplied column names, database objects and structures, usernames, and roles.	You can specify this clause only for a `NUMBER` column. You can back up the database by using the `BACKUP` command. Query the `TABLE_NAME` column in the `USER_TABLES` data dictionary view. Use the `DBMS_STATS.GENERATE_STATS` procedure.
`lowercase monospace (fixed-width) font`	Lowercase monospace typeface indicates executables, filenames, directory names, and sample user-supplied elements. Such elements include computer and database names, net service names, and connect identifiers, as well as user-supplied database objects and structures, column names, packages and classes, usernames and roles, program units, and parameter values. **Note:** Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown.	Enter `sqlplus` to open SQL*Plus. The password is specified in the `orapwd` file. Back up the data files and control files in the `/disk1/oracle/dbs` directory. The `department_id`, `department_name`, and `location_id` columns are in the `hr.departments` table. Set the `QUERY_REWRITE_ENABLED` initialization parameter to `true`. Connect as `oe` user. The `JRepUtil` class implements these methods.

Convention	Meaning	Example
lowercase italic monospace (fixed-width) font	Lowercase italic monospace font represents place holders or variables.	You can specify the *parallel_clause*. Run *old_release*.SQL where *old_release* refers to the release you installed prior to upgrading.

Conventions in Code Examples

Code examples illustrate SQL, PL/SQL, SQL*Plus, or other command-line statements. They are displayed in a monospace (fixed-width) font and separated from normal text as shown in this example:

```
SELECT username FROM dba_users WHERE username = 'MIGRATE';
```

The following table describes typographic conventions used in code examples and provides examples of their use.

Convention	Meaning	Example
[ ]	Brackets enclose one or more optional items. Do not enter the brackets.	`DECIMAL (`*`digits`*` [ , `*`precision`*` ])`
|	A vertical bar represents a choice of two or more options within brackets or braces. Enter one of the options. Do not enter the vertical bar.	`{ENABLE | DISABLE}` `[COMPRESS | NOCOMPRESS]`
...	Horizontal ellipsis points indicate either: ■ That we have omitted parts of the code that are not directly related to the example	`CREATE TABLE ... AS `*`subquery`*`;`
	■ That you can repeat a portion of the code	`SELECT `*`col1`*`, `*`col2`*`, ... , `*`coln`*` FROM employees;`
Other notation	You must enter symbols other than brackets, braces, vertical bars, and ellipsis points as shown.	`acctbal NUMBER(11,2);` `acct CONSTANT NUMBER(4) := 3;`
Italics	Italicized text indicates place holders or variables for which you must supply particular values.	`CONNECT SYSTEM/`*`system_password`* `DB_NAME = `*`database_name`*

Convention	Meaning	Example

UPPERCASE	Uppercase typeface indicates elements supplied by the system. We show these terms in uppercase in order to distinguish them from terms you define. Unless terms appear in brackets, enter them in the order and with the spelling shown. However, because these terms are not case sensitive, you can enter them in lowercase.	`SELECT last_name, employee_id FROM employees;`
		`SELECT * FROM USER_TABLES;`
		`DROP TABLE hr.employees;`

lowercase	Lowercase typeface indicates programmatic elements that you supply. For example, lowercase indicates names of tables, columns, or files.
	Note: Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown.
		`SELECT last_name, employee_id FROM employees;`
		`sqlplus hr/hr`
		`CREATE USER mjones IDENTIFIED BY ty3MU9;`

1

Overview of Tag Libraries and Utilities

This manual documents tag libraries, JavaBeans, and other utilities supplied with OC4J that are implemented according to JSP standards. There is also a discussion of support for the JavaServer Pages Standard Tag Library (JSTL), and a section summarizing tag libraries provided with other components of the Oracle9*i* Application Server.

Oracle-specific features, as well as an introduction to the OC4J JSP container, standard JSP technology, and standard JSP 1.2 tag library features, are covered in the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide.*

This chapter covers the following topics:

- Overview of Tag Libraries and Utilities Provided with OC4J
- Summary of Oracle Caching Support for Web Applications
- Support for the JavaServer Pages Standard Tag Library
- Overview of Tag Libraries from Other Oracle9iAS Components

Tags and JavaBeans introduced in the first section provide functionality in several different areas, including type extensions, integration with XML/XSL, database access, and programming convenience.

Overview of Tag Libraries and Utilities Provided with OC4J

The Oracle extensions introduced in this section are implemented through tag libraries or custom JavaBeans that comply with JSP and JavaBeans standards.

Here is a list of the topics covered:

- Tag Syntax Symbology and Notes
- Overview of Extended Type JavaBeans
- Overview of JspScopeListener for Event-Handling
- Overview of Integration with XML and XSL
- Summary of Data-Access JavaBeans and Tag Library
- Summary of JSP Markup Language (JML) Custom Tag Library
- Summary of Oracle9iAS Personalization Tag Library
- Summary of Web Services Tags
- Summary of JSP Utility Tags

Notes:

- See "Summary of Oracle Caching Support for Web Applications" on page 1-18 for information about tag libraries provided with OC4J to support caching features.
- See the OC4J demos for sample applications using the features introduced in this section.

Tag Syntax Symbology and Notes

For the syntax documentation in tag descriptions throughout this manual, note the following:

- *Italic* indicates that you must specify a value or string.
- Optional attributes are enclosed in square brackets: [. . .]
- Default values of optional attributes are indicated in **bold**.
- Choices in how to specify an attribute are separated by vertical bars: |

- Except where noted, you can use JSP runtime expressions to set tag attribute values: "`<%= jspExpression %>`"
- Tag descriptions in this manual use certain tag prefixes by convention; however, you can designate any desired prefix in your `taglib` directives.

Overview of Extended Type JavaBeans

JSP pages generally rely on core Java types in representing scalar values. However, neither of the following standard type categories is fully suitable for use in JSP pages:

- primitive types such as `int`, `float`, and `double`

  Values of these types cannot have a specified scope—they cannot be stored in a JSP scope object (for `page`, `request`, `session`, or `application` scope), because only objects can be stored in a scope object.

- wrapper classes in the standard `java.lang` package, such as `Integer`, `Float`, and `Double`

  Values of these types are objects, so they can theoretically be stored in a JSP scope object. However, they cannot be declared in a `jsp:useBean` action, because the wrapper classes do not follow the JavaBean model and do not provide zero-argument constructors.

  Additionally, instances of the wrapper classes are immutable. To change a value, you must create a new instance and assign it appropriately.

To work around these limitations, OC4J provides the `JmlBoolean`, `JmlNumber`, `JmlFPNumber`, and `JmlString` JavaBean classes in package `oracle.jsp.jml` to wrap the most common Java types.

For information, see Chapter 2, "JavaBeans for Extended Types".

Overview of JspScopeListener for Event-Handling

OC4J provides the `JspScopeListener` interface for lifecycle management of Java objects of various scopes within a JSP application.

Standard servlet and JSP event-handling is provided through the `javax.servlet.http.HttpSessionBindingListener` interface, but this is for session-based events only. The Oracle `JspScopeListener` can be integrated with `HttpSessionBindingListener` to manage session-based events, and can handle page-based, request-based, and application-based events as well.

For information, see "JSP Event-Handling with JspScopeListener" on page 8-2.

Overview of Integration with XML and XSL

You can use JSP syntax to generate any text-based MIME type, not just HTML code. In particular, you can dynamically create XML output. When you use JSP pages to generate an XML document, however, you often want a stylesheet applied to the XML data before it is sent to the client. This is difficult in JavaServer Pages technology, because the standard output stream used for a JSP page is written directly back through the server.

OC4J provides special tags to specify that all or part of a JSP page should be transformed through an XSL stylesheet before it is output. Input can be from the tag body or from an XML DOM object, and output can be to an XML DOM object to the browser.

You can use these tags multiple times in a single JSP page if you want to specify different style sheets for different portions of the page.

There is additional XML support as well:

- A utility tag converts data from an input stream to an XML DOM object.
- Several tags, for such features as caching and SQL operations, now can take XML objects as input or send them as output.

XML utility tags are summarized in Table 1–1. Note that there is also XML functionality in the `dbOpen` SQL tag and the `cacheXMLObj` Web Object Cache tag. For more information, see Chapter 5, "XML and XSL Tag Support".

You can find information about standard JSP 1.2 XML support in the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide.*

Note: The custom XML tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

Table 1–1 Summary of XML Utility Tags

Tag	Description	Attributes
transform	Output XML data with an XSL transformation, either to an HTTP client or a specified XML DOM object.	href fromXMLObjName toXMLObjName toWriter
styleSheet	Same as `transform` tag.	href fromXMLObjName toXMLObjName toWriter
parsexml	Convert from an input stream to an XML DOM object.	resource toXMLObjName validateResource root

Summary of Data-Access JavaBeans and Tag Library

OC4J supplies a set of custom JavaBeans for use in accessing the Oracle9*i* database. The following beans are provided in the `oracle.jsp.dbutil` package:

- `ConnBean` opens a database connection. This bean also supports data sources and connection pooling.
- `ConnCacheBean` uses the Oracle connection caching implementation for database connections. (This requires JDBC 2.0.)
- `DBBean` executes a database query.
- `CursorBean` provides general DML support for queries; `UPDATE`, `INSERT`, and `DELETE` statements; and stored procedure calls.

For information, see "JavaBeans for Data Access" on page 4-2.

For JSP programmers, OC4J also provides a custom tag library for SQL functionality, wrapping the functionality of the JavaBeans. These tags are summarized in Table 1–2. For further information, see "SQL Tags for Data Access" on page 4-16.

Note: The custom SQL tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

Table 1–2 Summary of Data-Access Tag Library

Tag	Description	Attributes
dbOpen	Open a database connection. This tag also supports data sources and connection pooling.	connId scope dataSource user password URL commitOnClose
dbClose	Close a database connection.	connId scope
dbQuery	Execute a query.	queryId connId scope output maxRows skipRows bindParams toXMLObjName
dbCloseQuery	Close the cursor for a query.	queryId
dbNextRow	Process the rows of a result set.	queryId
dbExecute	Execute any SQL statement (DML or DDL).	connId scope output bindParams

Table 1–2 Summary of Data-Access Tag Library (Cont.)

Tag	Description	Attributes
dbSetParam	Set a parameter to bind into a `dbQuery` or `dbExecute` tag.	name value scope
dbSetCookie	Set a cookie.	name value domain comment maxAge version secure path

Summary of JSP Markup Language (JML) Custom Tag Library

Although the Sun Microsystems *JavaServer Pages Specification, Version 1.1* (and higher) supports scripting languages other than Java, Java is the primary language used. Even though JavaServer Pages technology is designed to separate the dynamic/Java development effort from the static/HTML development effort, it is a hindrance if the Web developer does not know any Java, especially in small development groups where no Java experts are available.

OC4J provides custom tags as an alternative—the JSP Markup Language (JML). The Oracle JML tag library provides an additional set of JSP tags so that you can script your JSP pages without using Java statements. JML provides tags for variable declarations, control flow, conditional branches, iterative loops, parameter settings, and calls to objects. The JML tag library also supports XML functionality, as noted previously.

The following example shows use of the JML `for` tag, repeatedly printing "Hello World" in progressively smaller headings (H1, H2, H3, H4, H5):

```
<jml:for id="i" from="<%= 1 %>" to="<%= 5 %>" >
     <H<%=i%>>
            Hello World!
     </H<%=i%>>
</jml:for>
```

The JML tag library is summarized in Table 1–3. For more information, see Chapter 3, "JSP Markup Language Tags".

Note: The custom JML tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

Table 1–3 Summary of JSP Markup Language Tag Library

Tag	Description	Attributes
useVariable	This tag offers a convenient alternative to the `jsp:useBean` tag for declaring simple variables.	id scope type value
useForm	This tag provides a convenient syntax for declaring variables and setting them to values passed in from the request.	id scope type param
useCookie	This tag offers a convenient syntax for declaring variables and setting them to values contained in cookies.	id scope type cookie
remove	This tag removes an object from its scope.	id scope
if	This tag evaluates a single conditional statement. If the condition is true, then the body of the `if` tag is executed.	condition
choose	The `choose` tag, with associated `when` and `otherwise` tags, provides a multiple conditional statement.	(none)
when	This is used with the `choose` tag.	condition
otherwise	This is optionally used with the `choose` and `when` tags.	(none)

Table 1–3 Summary of JSP Markup Language Tag Library (Cont.)

Tag	Description	Attributes
for	This tag provides the ability to iterate through a loop, as with a Java `for` loop.	id from to
foreach	This tag provides the ability to iterate over a homogeneous set of values in a Java array, `Enumeration` instance, or `Vector` instance.	id in limit type
return	When this tag is reached, execution returns from the page without further processing.	(none)
flush	This tag writes the current contents of the page buffer back to the client. This applies only if the page is buffered; otherwise, there is no effect.	(none)

Note: Oracle JSP container versions preceding the JSP 1.1 specification use an Oracle-specific compile-time implementation of the JML tag library. Oracle still supports this implementation as an alternative to the standard runtime implementation, as documented in Appendix A, "JML Compile-Time Syntax and Tags".

Summary of Oracle9*i*AS Personalization Tag Library

Web site personalization is a mechanism to tailor recommendations to users of a site, based on behavioral and demographic data. Recommendations are made in real-time, during a user's Web session. User behavior is saved to a database repository for use in building models for predictions of future user behavior.

Oracle9*i*AS Personalization uses data mining algorithms in the Oracle database to choose the most relevant content available for a user. Recommendations are calculated by an Oracle9*i*AS Personalization recommendation engine, using typically large amounts of data regarding past and current user behavior. This is superior to other approaches that rely on common-sense heuristics and require manual definition of rules in the system.

The Oracle9*i*AS Personalization tag library brings this functionality to a wide audience of JSP developers for use in HTML, XML, or JavaScript pages. The tag interface is layered on top of the Java API of the recommendation engine.

Table 1–4 summarizes the Oracle9*i*AS Personalization tag library. See Chapter 9, "Oracle9iAS Personalization Tags" for information.

Table 1–4 Summary of Oracle9iAS Personalization Tag Library

Tag	Description	Attributes
startRESession	Use this tag to start an Oracle9*i*AS Personalization recommendation engine session.	RERName REURL RESchema REPassword RECacheSize REFlushInterval applicationSession createSession userType userID storeUserIDIn disableRecording
endRESession	Use this tag to explicitly end a recommendation engine session.	(none)
setVisitorToCustomer	Use this tag for situations where an anonymous visitor creates a registered customer account.	customerID
getRecommendations	Use this tag to request a set of recommendations for purchasing, navigation, or ratings.	from fromHotPicksGroups storeResultsIn storeInterestDimensionIn maxQuantity tuningName tuningDataSource tuningInterestDimension tuningPersonalizationIndex tuningProfileDataBalance tuningProfileUsage filteringName filteringTaxonomyID filteringMethod filteringCategories sortOrder

Table 1–4 Summary of Oracle9iAS Personalization Tag Library (Cont.)

Tag	Description	Attributes
getCrossSellRecommendations	Use this tag to request a set of recommendations for purchasing, navigation, or ratings, based on input of a set of past items (such as past purchases) that are used as a basis for the recommendations.	storeResultsIn storeInterestDimensionIn fromHotPicksGroups inputItemList maxQuantity tuningName tuningDataSource tuningInterestDimension tuningPersonalizationIndex tuningProfileDataBalance tuningProfileUsage filteringName filteringTaxonomyID filteringMethod filteringCategories sortOrder
selectFromHotPicks	Use this tag to request recommendations from a set of "hot picks" groups only.	hotPicksGroups storeResultsIn storeInterestDimensionIn maxQuantity tuningName tuningDataSource tuningInterestDimension tuningPersonalizationIndex tuningProfileDataBalance tuningProfileUsage filteringName filteringTaxonomyID filteringMethod filteringCategories sortOrder
evaluateItems	Use this tag to evaluate only the set of items that are input to the tag.	storeResultsIn taxonomyID inputItemList tuningName tuningDataSource tuningInterestDimension tuningPersonalizationIndex tuningProfileDataBalance tuningProfileUsage sortOrder

Table 1–4 Summary of Oracle9iAS Personalization Tag Library (Cont.)

Tag	Description	Attributes
forItem	Use this tag to select individual items input to a tag that requires an input list.	index itemList type ID
getNextItem	Optionally use this tag within some recommendation tags to access and process returned items.	storeTypeIn storeIDIn storeItemIn
recordNavigation	Use this tag to record a navigation item into the recommendation engine session cache.	type ID index itemList
recordPurchase	Use this tag to record a purchasing item into the recommendation engine session cache.	type ID index itemList
recordRating	Use this tag to record a rating item into the recommendation engine session cache.	value type ID index itemList
recordDemographic	Use this tag to record a demographic item into the recommendation engine session cache.	type value
removeNavigationRecord	Use this tag to remove a navigation item that had been recorded into the recommendation engine session cache earlier in the session.	type ID index itemList
removePurchaseRecord	Use this tag to remove a purchasing item that had been recorded into the recommendation engine session cache earlier in the session.	type ID index itemList

Table 1–4 Summary of Oracle9iAS Personalization Tag Library (Cont.)

Tag	Description	Attributes
removeRatingRecord	Use this tag to remove a rating item that had been recorded into the recommendation engine session cache earlier in the session.	value type ID index itemList
removeDemographicRecord	Use this tag to remove a demographic item that had been recorded into the recommendation engine session cache earlier in the session.	type value

Summary of Web Services Tags

The Web services tag library provided with OC4J enables developers to conveniently create JSP pages for Web service client applications. The implementation uses a SOAP-based, RPC-style mechanism. A client application would access a Web Services Definition Language (WSDL) document, then use the WSDL information to access the operations of a Web service.

The tag library also uses the Oracle implementation of the dynamic invocation API, described in the *Oracle9iAS Web Services Developer's Guide*. When a client application acquires a WSDL document at runtime, the dynamic invocation API is the vehicle for invoking any SOAP operation described in the WSDL document.

The Web services tag library is summarized in Table 1–5. For more information, see Chapter 10, "Web Services Tags".

Table 1–5 Summary of Web Services Tag Library

Tag	Description	Attributes
webservice	Use this tag to create a Web service proxy. The tag requires the URL of a WSDL document and uses either a binding and SOAP location or a service name and port in creating the proxy.	wsdlUrl id scope binding soapLocation service port

Table 1–5 Summary of Web Services Tag Library (Cont.)

Tag	Description	Attributes
map	Use `map` tags nested within a `webservice` tag to have the Web service proxy add entries to the SOAP mapping registry for type mapping between SOAP/XML and Java. Use one `map` tag for each desired type mapping.	localName namespaceUri javaType encodingStyle java2xmlClassName xml2javaClassName
property	Optionally use this tag to specify a name/value pair that defines any of several supported custom properties for use by the Web service client application.	name value
invoke	Use this tag to invoke an operation of a Web service. The `invoke` tag gains access to a Web service proxy either by being nested within a `webservice` tag or by accessing a Web service proxy scripting variable created in a `webservice` tag.	id operation webservice inputMsgName outputMsgName
part	Use this tag if the operation being performed requires input message part values, using one part tag for each input part.	name value

Summary of JSP Utility Tags

OC4J provides utility tags to accomplish the following from within Web applications:

- sending e-mail messages
- uploading and downloading files
- using EJBs
- using miscellaneous utilities

For sending e-mail messages, optionally with server-side or client-side attachments, you can use the `oracle.jsp.webutil.email.SendMailBean` JavaBean or the `sendMail` tag. Table 1–6 summarizes the `sendMail` tag. See "Mail JavaBean and Tag" on page 8-14 for more information.

Table 1–6 Summary of sendMail Tag

Tag	Description	Attributes
sendMail	Send an e-mail message from a JSP page. Tag functionality includes globalization support.	host sender recipient cc bcc subject contentType contentEncoding serverAttachment clientAttachment

For uploading files, you can use the `httpUpload` tag or the `oracle.jsp.webutil.fileaccess.HttpUploadBean` JavaBean. For downloading, there is the `httpDownload` tag or the `HttpDownloadBean` JavaBean. Table 1–7 summarizes the file access tags. For more information see "File-Access JavaBeans and Tags" on page 8-29.

Table 1–7 Summary of File Access Tag Library

Tag	Description	Attributes
httpUploadForm	For convenience, you can use this tag to create a form in your application, using multipart encoded form data, that allows users to specify the files to upload.	formsAction maxFiles fileNameSize maxFileNameSize includeNumbers submitButtonText
httpUpload	Upload files from the client to a server. You can upload into either a file system or a database.	destination destinationType connId scope overwrite fileType table prefixColumn fileNameColumn dataColumn

Table 1–7 Summary of File Access Tag Library (Cont.)

Tag	Description	Attributes
httpDownload	Download files from a server to the client. You can download from either a file system or a database.	servletPath source sourceType connId scope recurse fileType table prefixColumn fileNameColumn dataColumn

For using EJBs, there are tags to create a home instance, create an EJB instance, and iterate through a collection of EJBs. Table 1–8 summarizes the EJB tag library. See "EJB Tags" on page 8-53 for more information.

Table 1–8 Summary of EJB Tag Library

Tag	Description	Attributes
useHome	This tag looks up the home interface for the EJB and creates an instance of it.	id type location
useBean	Use this tag for instantiating and using the EJB. Its functionality has similarities to the standard `jsp:useBean` tag for a JavaBean.	id type value scope
createBean	For first instantiating an EJB, if you do not use the `value` attribute of the EJB `useBean` tag, you must nest an EJB `createBean` tag within the `useBean` tag to do the work of creating the EJB instance.	instance
iterate	Use this tag to iterate through a collection of EJB instances (more typical for entity beans).	id type collection max

There are also utility tags for displaying a date, displaying an amount of money in the appropriate currency, displaying a number, iterating through a collection, evaluating and including the tag body depending on whether the user belongs to a specified role, and displaying the last modification date of the current file. Table 1–9

summarizes these tags. See "General Utility Tags" on page 8-61 for more information.

Table 1–9 Summary of General Utility Tag Library

Tag	Description	Attributes
displayCurrency	This tag displays a specified amount of money, formatted as currency for the locale.	amount locale
displayDate	This tag displays a specified date, formatted appropriately for the locale.	date locale
displayNumber	This displays the specified number, for the locale and optionally in the specified format.	number locale format
iterate	Use this tag to iterate through a collection.	id type collection max
ifInRole	Use this tag to evaluate the tag body and include it in the body of the JSP page, depending on whether the user is in the specified application role.	role include
lastModified	This tag displays the date of the last modification of the current file, in appropriate format for the locale.	locale

Summary of Oracle Caching Support for Web Applications

This section provides the following information:

- an introduction to caching features supported by the Oracle9*i* Application Server in general and the OC4J JSP container in particular
- a discussion of the role of the OC4J Web Object Cache in relation to other Oracle9*i* Application Server caching components
- a summary of tag libraries relating to caching features

The Oracle tag libraries introduced in this section are JSP standards-compliant.

Note: See the OC4J demos for sample applications using the features introduced in this section.

Oracle9*i* Application Server and JSP Caching Features

The Oracle9*i* Application Server and OC4J provide the following caching features:

- Oracle9*i*AS Web Cache

  This is an HTTP-level cache, maintained outside the application, providing very fast cache operations. It is a pure, content-based cache, capable of caching static data (such as HTML, GIF, or JPEG files) or dynamic data (such as servlet or JSP results). Given that it exists as a flat content-based cache outside the application, it cannot cache objects (such as Java objects or XML DOM objects) in a structured format. In addition, it has relatively limited post-processing abilities on cached data.

  The Oracle9*i*AS Web Cache provides an ESI processor to support Edge Side Includes, an XML-style markup language that allows dynamic content assembly away from the Web server. This technology enables you to break cacheable pages into separate cached objects, as desired. OC4J supports this technology through its JESI tag library.

  For an overview of Edge Side Includes and the Oracle9*i*AS Web Cache, as well as detailed documentation of the JESI tag library, see Chapter 6, "JESI Tags for Edge Side Includes".

  For additional information about the Oracle9*i*AS Web Cache, see the *Oracle9iAS Web Cache Administration and Deployment Guide*.

- OC4J Web Object Cache

  This is an application-level cache, embedded and maintained within a Java Web application. It is a hybrid cache, both Web-based and object-based. A custom tag library or API enables you to define page fragment boundaries and to capture, store, reuse, process, and manage the intermediate and partial execution results of JSP pages and servlets as cached objects. Each block can produce its own resulting cache object. The produced objects can be HTML or XML text fragments, XML DOM objects, or Java serializable objects. These objects can be cached conveniently in association with HTTP semantics. Alternatively, they can be reused outside HTTP, such as in outputting cached XML objects through Simple Mail Transfer Protocol (SMTP), Java Messaging Service (JMS), Advanced Queueing (AQ), or Simple Object Access Protocol (SOAP).

  For more information, see Chapter 7, "Web Object Cache Tags and API".

- Oracle9*i* Application Server Java Object Cache

  The Oracle9*i* Application Server Java Object Cache is a general-use cache to manage Java objects within a process, across processes, and on local disk. By managing local copies of objects that are difficult or expensive to retrieve or create, the Java Object Cache significantly improves server performance. By default, the OC4J Web Object Cache uses the Oracle9*i* Application Server Java Object Cache as its underlying cache repository.

  For details, see the *Oracle9iAS Containers for J2EE Services Guide*.

Role of the JSP Web Object Cache

It is important to understand the role of the OC4J Web Object Cache in the overall setup of a Web application. It works at the Java level and is closely integrated with the HTTP environment of servlet and JSP applications. By contrast, the Oracle9*i* Application Server Java Object Cache works at the Java object level, but is not integrated with HTTP. As for the Oracle9*i*AS Web Cache, it is well integrated with HTTP and is an order of magnitude faster than the Web Object Cache, but it does not operate at the Java level. For example, it cannot apply a stylesheet to a cached DOM object within the J2EE container, reuse the cached result in other protocols, or allow direct DOM operations. (Oracle9*i*AS Web Cache can, however, apply a stylesheet to raw XML documents, as opposed to DOM objects, that were cached from the original Web server through HTTP.)

The Web Object Cache is *not* intended for use as the main Web cache for an application. It is an auxiliary cache embedded within the same Java virtual machine

that is running your servlets and JSP pages. Because the retrieval path for cached results in the Web Object Cache includes the JVM and the JSP and servlet engines, it generally takes much longer to serve a page from the Web Object Cache compared to the Oracle9*i*AS Web Cache.

The Web Object Cache does not replace or eliminate the need for either the Oracle9*i*AS Web Cache or the Oracle9*i* Application Server Java Object Cache—it is a complementary caching component in the overall framework of a Web application and should be used together with the other caching products, as appropriate. In fact, the Web Object Cache uses the Java Object Cache as its default repository. And through combined use of the OC4J JESI tags and Web Object Cache tags, you can use the Web Object Cache and Oracle9*i*AS Web Cache together in the same page.

Web Object Cache Versus Oracle9*i*AS Web Cache

Think of the Oracle9*i*AS Web Cache as the primary caching component. It serves cached pages directly to HTTP clients and handles large volumes of HTTP traffic quickly, fitting the requirements of most Web sites. You can use the Oracle9*i*AS Web Cache to store complete Web pages or partial pages (through use of the JESI tags). Cached pages can be customized, to a certain extent, before being sent to a client, including cookie-replacement and page-fragment concatenation, for example.

It is advisable to use the Oracle9*i*AS Web Cache as much as possible to reduce the load on the Web application server and back-end database. The caching needs of a large percentage of Web pages can be addressed by the Oracle9*i*AS Web Cache alone.

As a complement to the Oracle9*i*AS Web Cache, you can use the Web Object Cache to capture intermediate results of JSP and servlet execution, and subsequently reuse these cached results in other parts of the Java application logic. It is not beneficial to use the Web Object Cache in your Web application unless you are doing a significant amount of post-processing on cached objects between the time they are cached and the time they are served to a client.

Web Object Cache Versus Oracle9*i* Application Server Java Object Cache

In comparison to the Oracle9*i* Application Server Java Object Cache, the Web Object Cache makes it much easier to store and maintain partial execution results in dynamic Web pages. The Java Object Cache, being a pure object-based framework for any general Java application, is not aware of the HTTP environment in which it may be embedded. For example, it does not directly depend on HTTP cookies or sessions. When you directly use the Java Object Cache within a Web application, you are responsible for creating any necessary interfacing. The Java Object Cache does not provide a way to specify maintenance policies declaratively.

Summary of Tag Libraries for Caching

OC4J supplies two tag libraries for use with Oracle9*i*AS caching features:

- JESI tag library
- Web Object Cache tag library

This section summarizes those libraries.

Summary of JESI Tag Library

OC4J provides the JESI tag library as a convenient interface to ESI tags and Edge Side Includes functionality for Web caching. Developers have the option of using ESI tags directly in any Web application, but JESI tags provide additional convenience in a JSP environment.

Table 1–10 summarizes the JESI tag library. See "Oracle JESI Tag Descriptions" on page 6-13 for more information.

Table 1–10 Summary of JESI Tag LIbrary

Tag	Description	Attributes
control	This tag controls caching characteristics for JSP pages in the control / include usage model. You can use a JESI `control` tag in the top-level page or any included page.	expiration maxRemovalDelay cache
include	This tag, like a standard `jsp:include` tag, dynamically inserts output from the included page into output from the including page. Additionally, it is directing that the included page be processed and assembled by the ESI processor.	page alt ignoreError copyparam flush
template	Use this tag to specify caching behavior for the aggregate page, outside any fragments, in the template / fragment usage model.	expiration maxRemovalDelay cache
fragment	Use one or more JESI `fragment` tags within a JESI `template` tag, between the JESI `template` start-tag and end-tag, in the template / fragment model.	expiration maxRemovalDelay cache
invalidate	Use this tag with its JESI `object` subtag to explicitly invalidate one or more cached objects.	url username password config output

Table 1–10 Summary of JESI Tag LIbrary (Cont.)

Tag	Description	Attributes
object	Use this required subtag of the JESI `invalidate` tag to specify cached objects to invalidate, according to either the complete URI or a URI prefix.	uri prefix maxRemovalDelay
cookie	Optionally use this subtag of the JESI `object` tag to use cookie information as a further criterion for invalidation.	name value
header	Optionally use this subtag of the JESI `object` tag to use HTTP/1.1 header information as a further criterion for invalidation.	name value
personalize	Use this tag to allow page customization, by informing the ESI processor of dependencies on cookie and session information.	name value

Summary of Web Object Cache Tag Library

The OC4J Web Object Cache is a mechanism that allows Web applications written in Java to capture, store, reuse, post-process, and maintain the partial and intermediate results generated by a dynamic Web page, such as a JSP page or servlet. For programming interfaces, it provides a tag library (for use in JSP pages) and a Java API (for use in servlets).

Table 1–11 summarizes the Web Object Cache tag library. See "Web Object Cache Tag Descriptions" on page 7-21 for more information.

Table 1–11 Summary of Web Object Cache Tag LIbrary

Tag	Description	Attributes
cache	Use this tag to set up general caching, as opposed to caching of XML objects or Java serializable objects, in a JSP application.	policy ignoreCache invalidateCache scope autoType selectedParam selectedCookies reusableTimeStamp reusableDeltaTime name expirationType TTL timeInaDay dayInaWeek dayInaMonth writeThrough printCacheBlockInfo printCachePolicy cacheRepositoryName reportException
cacheXMLObj	Generally speaking, use this tag instead of the `cache` tag if you are caching XML DOM objects. The `cacheXMLObj` tag supports all the `cache` tag attributes, as well as additional XML-specific parameters.	policy ignoreCache invalidateCache scope autoType selectedParam selectedCookies reusableTimeStamp reusableDeltaTime name expirationType TTL timeInaDay dayInaWeek dayInaMonth writeThrough printCacheBlockInfo printCachePolicy cacheRepositoryName reportException fromXMLObjName toXMLObjName toWriter

Table 1–11 Summary of Web Object Cache Tag LIbrary (Cont.)

Tag	Description	Attributes
useCacheObj	Use this tag to cache any Java serializable object. The `useCacheObj` tag supports all the `cache` tag parameters, as well as additional attributes specific to its functionality.	policy ignoreCache invalidateCache scope autoType selectedParam selectedCookies reusableTimeStamp reusableDeltaTime name expirationType TTL timeInaDay dayInaWeek dayInaMonth writeThrough printCacheBlockInfo printCachePolicy cacheRepositoryName reportException type id cacheScope
cacheInclude	This tag combines functionality of the `cache` tag (but not the `cacheXMLObj` tag or `useCacheObj` tag) and the standard `jsp:include` tag.	policy page printCacheBlockInfo reportException
invalidateCache	Use this tag to explicitly invalidate a cache block through program logic. Most parameters of the `invalidateCache` tag also exist in the `cache` and `cacheXMLObj` tags and are used in the same way.	policy ignoreCache scope autoType selectedParam selectedCookies name invalidateNameLike page autoInvalidateLevel cacheRepositoryName reportException

Support for the JavaServer Pages Standard Tag Library

With Oracle9*i*AS release 2 (9.0.3), the OC4J JSP product supports the JavaServer Pages Standard Tag Library (JSTL), as specified in the Sun Microsystems *JavaServer Pages Standard Tag Library*, *Version 1.0* specification. This section provides an overview of JSTL features and OC4J support, covering the following topics:

- Overview and Philosophy of JSTL
- Summary of JSTL Expression Language
- Overview of JSTL Tags and Additional Features
- JSTL in Oracle9iAS Release 2: Usage Notes and Future Considerations

As of the OC4J 9.0.3 implementation, JSTL is not yet directly included with the OC4J product. You can download the reference implementation from:

```
http://jakarta.apache.org/builds/jakarta-taglibs/releases/standard/
```

For information about using this JSTL reference implementation with the OC4J demo applications, refer to the JSP FAQ document, available through:

```
http://otn.oracle.com/tech/java/oc4j
```

For complete information about JSTL, refer to the specification at the following location:

```
http://www.jcp.org/aboutJava/communityprocess/first/jsr052/index.html
```

Note: JSTL 1.0 requires a JSP 1.2 environment.

Overview and Philosophy of JSTL

JSTL is intended as a convenience for JSP page authors who are not familiar or not comfortable with scripting languages such as Java. Historically, scriptlets have been used in JSP pages to process dynamic data. With JSTL, the intent is for JSTL tag usage to replace the need for scriptlets.

Readers who have used previous versions of the OC4J JSP product will recognize this as similar to the goals of the Oracle JavaServer Pages Markup Language (JML) tag library. While the JML tag library is still supported, use of the standard JSTL is encouraged. Also see "JSTL in Oracle9iAS Release 2: Usage Notes and Future Considerations" on page 1-33.

Key JSTL features include the following:

- JSTL expression language (EL)

  The expression language further simplifies the code required to access and manipulate application data, making it possible to avoid request-time expressions as well as scriptlets. See the next section, "Summary of JSTL Expression Language".

- core tags for expression language support, conditional logic and flow control, iterator actions, and accessing URL-based resources
- tags for XML processing, flow control, and XSLT transformations
- SQL tags for database access
- tags for i18n-capable internationalization and formatting

  (The term "i18n" refers to an internationalization standard.)

Tag support is broken into four JSTL sublibraries according to the preceding functional areas. Table 1–12 shows the standard TLD URI and prefix for each sublibrary.

Table 1–12 JSTL Sublibraries

Functionality	URI	Prefix
core	`http://java.sun.com/jstl/core`	c:
XML processing	`http://java.sun.com/jstl/xml`	x:
SQL database access	`http://java.sun.com/jstl/sql`	sql:
i18n internationalization and formatting	`http://java.sun.com/jstl/fmt`	fmt:

See "Overview of JSTL Tags and Additional Features" on page 1-30 for more information.

Note: Given the constraints of having to work with JSP 1.2 containers, the JSTL 1.0 implementation was required to support both the expression language model and the request-time expression model. This dual support is accomplished through parallel JSTL sublibraries. For each sublibrary (core, XML, SQL, and i18n) there are separate TLDs, and hence separate TLD URIs, for the two versions.

It is expected that most users will want to use the expression language model, corresponding to the URIs listed previously. To use the request-time expression model, add "`_rt`" to each URI in order to access the appropriate TLDs. By convention, add "`_rt`" to each prefix as well ("`c_rt:`", for example).

In any particular JSP page, use one set of libraries or the other, but not both.

Summary of JSTL Expression Language

The JSTL expression language makes use of the fact that JSP scoped attributes and request parameters are the preferred vehicles for passing information to and from JSP pages. By using the JSTL expression language, you can avoid having to use JSP scriptlets and request-time expressions.

In JSTL 1.0, the expression language can be used only in JSTL tag attribute values.

As an example, consider the following use of the JSTL `c:if` tag to pick out steel-making companies from a company list:

```
<c:if test="${company.industry == 'steel'}">
   ...
</c:if>
```

The rest of this section summarizes JSTL expression language syntax and documents how to enable JSTL expression language evaluation in your OC4J JSP applications.

JSTL Expression Language Syntax

This following list offers a brief summary of key syntax features of the JSTL expression language. This is followed by a few simple examples.

- invocation

  The JSTL expression language is invoked through `${`*`expression`*`}` syntax. The most basic semantic is that invocation for a named variable `${foo}` yields the same result as the method call `PageContext.findAttribute(foo)`.

- data structure access

  To access data within JavaBeans and within collections such as lists, maps, and arrays, the expression language supports the "`.`" and "`[]`" constructs. The "`.`" construct allows access to properties whose names are standard Java identifiers. The "`[]`" construct is for more generalized access, but for valid Java identifiers is equivalent to the "`.`" construct. The expressions `foo.bar` and `foo["bar"]` yield the same result.

- relational operators

  The expression language supports the relational operators `==` (or `eq`), `!=` (or `ne`), `<` (or `lt`), `>` (or `gt`), `<=` (or `le`), `>=` (or `ge`).

- arithmetic operators

  The expression language supports the arithmetic operators `+`, `-`, `*`, `/` (or `div`), `%` (or `mod`, for remainder or modulo).

- logical operators

  The expression language supports the logical operators `&&` (or `and`), `||` (or `or`), `!` (or `not`), `empty`.

Example: Basic The following example shows fairly basic invocations of the expression language, including the relational "`<=`" (less than or equal to) operator.

```
<c:if test="${auto.price <= customer.priceLimit}">
   The <c:out value="${auto.makemodel}"/> is in your price range.
</c:if>
```

Example: Accessing Collections The following example, from the Sun Microsystems *JavaServer Pages Standard Tag Library, Version 1.0* specification, shows use of the "`.`" and "`[]`" constructs.

```
<%-- "productDir" is a Map object containing the description of
      products, "preferences" is a Map object containing the
      preferences of a user --%>
product:
<c:out value="${productDir[product.custId]}"/>
shipping preference:
<c:out value="${user.preferences['shipping']}"/>
```

JSTL Expression Language Implicit Objects

JSTL offers the following implicit objects:

- `pageScope`—Allows access to page-scope variables.
- `requestScope`—Allows access to request-scope variables.
- `sessionScope`—Allows access to session-scope variables.
- `applicationScope`—Allows access to application-scope variables.
- `pageContext`—Allows access to all properties of the page context of a JSP page.
- `param`—This is a Java `Map` object where `param["foo"]` returns the first string value associated with the request parameter `foo`.
- `paramValues`—`paramValues["foo"]` returns an array of all string values associated with request parameter `foo`.
- `header`—Similarly to using `param`, you can use this to access the first string value associated with a request header.
- `headerValues`—Similarly to using `paramValues`, you can use this to access all string values associated with a request header.
- `initParam`—Allows access to context initialization parameters.
- `cookie`—Allows access to cookies received in the request.

JSTL Expression Language Additional Features

The expression language also offers the following features:

- It can provide default values where failure to evaluate an expression is considered to be recoverable.

- Where application data might not exactly match the type expected by a tag attribute or expression language operator, there are rules to convert the type of the resulting value to the expected type.

See the JSTL 1.0 specification for information.

Overview of JSTL Tags and Additional Features

This section provides a summary of JSTL tags and discusses some additional JSTL features. The following topics are covered:

- Scoped Variables
- Configuration Data and the Config Class
- JSTL Tag Summary

Scoped Variables

JSTL tags make data available through JSP scoped attributes, referred to as *scoped variables*, which are used in place of scripting variables. JSTL tags that can make data available in this way have `var` and `scope` among their attributes, used as follows:

- `var`—Specify the variable that is to be exposed.
- `scope`—Specify the scope of the variable, either `page` (default), `request`, `session`, or `application`.

The `scope` attribute would not be relevant for `NESTED` variables (which would always have `page` scope), but variables in the JSTL are `AT_END` (available from the end-tag to the end of the page).

The following example uses the core library iterator action tag `forEach` and expression language support tag `out` to expose the current item of an `employees` collection:

```
<c:forEach var="employee" items="${customers}">
   The current employee is <c:out value="${customer}"/>
</c:forEach>
```

Configuration Data and the Config Class

JSTL includes functionality to dynamically override JSP configuration data for a particular scope, through a scoped variable. You can accomplish this using functionality of the `javax.servlet.jsp.jstl.core.Config` class.

According to the JSP 1.2 specification, all scopes (`page`, `request`, `session`, and `application`) that exist within a JSP page context should together form a single namespace; that is, the name of a scoped variable should be unique across execution of a page.

The `Config` class has functionality to transparently manipulate configuration parameter names to produce the effect that each scope has its own namespace. Effectively, this enables you to set a configuration parameter for a particular scope only.

See the JSTL 1.0 specification for information.

JSTL Tag Summary

Table 1–13 summarizes the JSTL tags, organized into functional groupings. The JSTL standard tag prefix is noted for each group.

Table 1–13 Summary of JavaServer Pages Standard Tag Library

Tag Group	Description of Group	Individual Tags
Core, EL support	Includes tags to evaluate an expression and output the result to the current `JspWriter` object, set the value of a scoped variable or of a property of a target object, remove a scoped variable, and catch a `Throwable` instance thrown by a nested action.	c:out c:set c:remove c:catch
Core, conditional	Includes tags to evaluate body content if a test attribute evaluates as `true`, and specify mutually exclusive conditional execution paths. The `when` and `otherwise` tags are used with the `choose` tag.	c:if c:choose c:when c:otherwise
Core, iterators	Includes tags to iterate body execution over a collection of objects (or just a specified number of times), and iterate over a set of tokens separated by supplied delimiters.	c:forEach c:forTokens
Core, URL-related	Includes tags to import the content of a URL-based resource, create a URL using appropriate rewriting rules, send an HTTP redirect to the client, and add a request parameter to a URL. The `param` tag is a subtag of the `import`, `url`, and `redirect` tags.	c:import c:url c:redirect c:param

Table 1–13 Summary of JavaServer Pages Standard Tag Library (Cont.)

Tag Group	Description of Group	Individual Tags
XML, core	Includes tags to parse an XML document, evaluate an XPath expression and output the result to the current `JspWriter` object, and evaluate an XPath expression and store the result in a scoped variable. (See the note after this table regarding XPath.)	x:parse x:out x:set
XML, flow control	Includes tags to evaluate a specified XPath expression and render its content if the expression evaluates as true, specify mutually exclusive conditional execution paths, and evaluate a specified XPath expression and repeat body execution over the result. The `when` and `otherwise` tags are used with the `choose` tag.	x:if x:choose x:when x:otherwise x:forEach
XML, transforms	Includes tags to apply an XSLT style sheet transformation to a document, and set transformation parameters. The `param` tag is a subtag of the `transform` tag.	x:transform x:param
SQL	Includes tags to query a database, update a database (`UPDATE` / `INSERT` / `DELETE`), establish a transaction context for queries and updates, export a data source as a scoped variable or data source configuration variable, set the values for parameter placeholders ("`?`") in a SQL statement, and set the values for parameter placeholders where the type is `java.util.Date`. The `param` and `dateParam` tags are subtags of the `query` and `update` tags.	sql:query sql:update sql:transaction sql:setDataSource sql:driver sql:param sql:dateParam
i18n, internationalization	Includes tags to store a specified locale in the locale configuration variable, create an i18n localization context for use within the tag, create a localization context and store it for use outside the tag, look up a localized message in a resource bundle, and set the request character encoding. The `param` tag can be used with the `message` tag to replace a parameter in the `message` tag.	fmt:locale fmt:bundle fmt:message fmt:param fmt:requestEncoding

Table 1–13 Summary of JavaServer Pages Standard Tag Library (Cont.)

Tag Group	Description of Group	Individual Tags
i18n, formatting	Includes tags to specify a time zone for formatting or parsing, store a specified time zone in a scoped variable or time zone configuration variable, format a numeric value as appropriate for a locale or special customization, parse the string representation of a numeric value that had been formatted for a locale or special customization, format a date or time for a locale or special customization, and parse the string representation of a date or time that had been formatted for a locale or special customization.	fmt:timeZone fmt:setTimeZone fmt:formatNumber fmt:parseNumber fmt:formatDate fmt:parseDate

Note: JSTL tags for XML processing are based on XPath (XML Path), a W3C recommendation. XPath provides a concise notation for specifying and selecting parts of an XML document. Refer to the following Web site for information:

```
http://www.w3.org/TR/xpath
```

JSTL in Oracle9*i*AS Release 2: Usage Notes and Future Considerations

Be aware off the following considerations:

- The JSTL expression language implementation might change somewhat in future versions of JSTL.
- The custom JML, XML, and SQL tag libraries provided with OC4J pre-date JSTL and have areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. Oracle is not desupporting the existing tags, however. For features in the custom libraries that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.
- Refer to the `ojsp/jstl` demos in your OC4J installation for examples of JSTL usage. Also check the Oracle9*i*AS release 2 (9.0.3) release notes for system property settings that are required for some of the demos.

Overview of Tag Libraries from Other Oracle9*i*AS Components

A number of other Oracle9*i*AS components provide JSP tag libraries. This section summarizes the following libraries:

- Oracle9i JDeveloper Business Components for Java (BC4J) Tag Library
- Oracle9i JDeveloper User Interface Extension (UIX) Tag Library
- Oracle9i JDeveloper BC4J / UIX Tag Library
- Oracle9i Reports Tag Library
- Oracle9iAS Wireless Location (Spatial) Tag Library
- Oracle9iAS Ultra Search Tag Library
- Oracle9iAS Portal Tag Library

The Oracle tag libraries introduced in this section are JSP standards-compliant.

The following discussion assumes some prior knowledge of the underlying components.

Oracle9*i* JDeveloper Business Components for Java (BC4J) Tag Library

Oracle9*i* JDeveloper provides a set of custom tags known as Business Components for Java (BC4J) data tags. BC4J data tags provide a simple tag-based approach for interaction with business component data sources. The tags provide complete access to business components and allow viewing, editing, and full DML control.

Custom data tags allow for simplified interaction with Business Components for Java data sources. The tag-based approach to building JSP applications with business components does not require extensive Java programming and is very much like coding an HTML page.

Table 1–14 summarizes the BC4J tag library. The typical tag prefix is `jbo`.

For more information, refer to the Oracle9*i* JDeveloper online help, or their documentation on the Oracle Technology Network:

`http://otn.oracle.com/products/jdev/content.html`

Note: Because of the size of this library, tags are not described individually.

Table 1–14 Summary of BC4J Tag Library

Tag Group	Description of Group	Individual Tags
Component tags	This group includes tags to display a form and edit a record, handle business component events, perform a search on a data source, display a record bound to a data source, display a table bound to a data source, and render database transaction operations.	DataEdit DataHandler DataNavigate DataQuery DataRecord DataScroller DataTable DataTransaction
Connection tags	This group includes tags to create an application module instance to service HTTP requests, apply changes made on a data source to the database, create a dynamic view object from an application module, create a JSP page data source, create a data source variable, post changes made on a data source to the database, reexecute the data of a data source, trigger the release of an application module instance, and roll back current data source changes.	ApplicationModule Commit CreateViewObject DataSource DataSourceRef PostChanges RefreshDataSource ReleasePageResources RollBack
Data access tags	This group includes tags to iterate through the data source attribute definition, set a `WHERE` clause, execute a SQL statement, display an attribute using a field renderer, retrieve a data row instance and perform an operation, iterate through the rows of a data source, move the viewing range of a data source, update an attribute in a row, display the criteria of a data item, display the meta data of an attribute, display the hints of an attribute, display an attribute value, set search view criteria, and iterate through the rows of view criteria.	AttributeIterate Criteria CriteriaRow ExecuteSQL RenderValue Row RowsetIterate RowsetNavigate SetAttribute ShowCriteria ShowDefinition ShowHint ShowValue ViewCriteria ViewCriteriaIterate
Event tags	This group includes tags to execute a business component event, handle a business component event, and build a URL for events.	FormEvent OnEvent UrlEvent

Table 1–14 Summary of BC4J Tag Library (Cont.)

Tag Group	Description of Group	Individual Tags
Forms tags	This group includes tags to insert an input date field, insert an input field, insert a hidden input field, insert a password field, overwrite the field renderer, and add HTML attributes to an input tag.	InputDate InputHidden InputPassword InputRender InputSelect InputSelectGroup InputSelectLOV InputText InputTextArea SetDomainRenderer SetFieldRenderer SetHtmlAttribute
*inter*Media tags	This group includes tags to insert an HTML `ANCHOR` tag for an *inter*Media object, insert an HTML `OBJECT` tag for an *inter*Media audio object, insert an HTML `IMAGE` tag for an *inter*Media image object, insert an HTML `OBJECT` tag for an *inter*Media video object, insert an HTML `FORM` tag for a file upload, and insert a URL string for an *inter*Media object.	AnchorMedia EmbedAudio EmbedImage EmbedVideo FileUploadForm MediaUrl
Web bean tags	This group includes tags to insert a Web bean or Data Web bean into a page.	DataWebBean WebBean

Oracle9*i* JDeveloper User Interface Extension (UIX) Tag Library

Oracle9*i* JDeveloper provides a set of custom tags known as User Interface Extension (UIX) tags. The tags invoke UIX controls, generating the HTML to render tabs, buttons, tables, headers, and other layout and navigational components that implement the Oracle browser look and feel.

The tags are included on several palette pages: UIX Page, UIX Layout, UIX Table, UIX Form, UIX Border Layout, and BC4J UIX. These support page layout, table layout, form layout, border layout, and data-binding to a business components project.

Table 1–15 summarizes the UIX tag library. The typical tag prefix is `uix`.

For more information, refer to the Oracle9*i* JDeveloper online help, or their documentation on the Oracle Technology Network:

`http://otn.oracle.com/products/jdev/content.html`

Note: Because of the size of this library, tags are not described individually.

Table 1–15 Summary of UIX Tag Library

Tag Group	Description of Group	Individual Tags
Border layout tags	This group includes tags to lay out indexed "children", specify the border above or below indexed children, and specify the border to the left or right of indexed children.	borderLayout bottom innerBottom innerEnd innerLeft innerRight innerStart innerTop left right top
Form tags	This group includes tags to create a browser input checkbox, display a menu-style list of input items, create a text field for entering dates and a button for selecting dates from a calendar, add a widget for uploading a file, create an HTML form in the page, add a value that will be submitted with a form, display a defined list of items for input, create a text field with a button for launching a list-of-values dialog, create a single option input field, insert a browser radio button, create a set of radio buttons, create a button to reset form content, insert a button for submitting a form, and create a single-line text field or multi-line text area.	checkBox choice dateField fileUpload form formValue list lovField option radioButton radioGroup resetButton submitButton textInput
Layout tags	This group includes tags to lay out children horizontally or vertically.	flowLayout stackLayout

Table 1–15 Summary of UIX Tag Library (Cont.)

Tag Group	Description of Group	Individual Tags
Page tags	This group consists of numerous tags to create and manipulate page content. Among many other functions, this includes inserting a trail of links back to the home page, building a UIX tree and saving it to the page context, inserting buttons, placing ancillary information on the page, creating a copyright or corporate branding section, inserting page footer links, adding a banner that can contain links for site navigation, placing labels, inserting images, inserting a text link, applying a template to the page, and inserting a CSS stylesheet.	body breadCrumbs buildTree button case cobranding contentContainer contentFooter contents copyright corporateBranding dataScope document end footer globalButton globalButtonBar globalButtons globalHeader header image inlineMessage labeledFieldLayout largeAdvertisement leading leadingFooter link location mediumAdvertisement messageBox messagePrompt messageStyledText navigationBar pageButtonBar pageHeader pageLayout privacy productBranding quickSearch rawText ref renderingContext separator shuttle sideNav

Table 1–15 Summary of UIX Tag Library (Cont.)

Tag Group	Description of Group	Individual Tags
Page tags	(continued)	spacer start styleSheet styledText switcher tabBar tabs tip trailing trailingFooter train
Table tags	This group includes tags that, among other functions, let users add rows of data and see updated data totals, add formatting, encapsulate formatting information for a table column, render a selection column for multiple selection of rows, stamp column headers for sorting, and support editing and formatting of tabular data.	addTableRow cellFormat column columnFooter columnHeader columnHeaderStamp hideShow multipleSelection rowLayout singleSelection sortableHeader table tableDetail tableLayout totalRow
Validation tags	This group of tags is to insert validators and tags relating to validation.	date decimal onBlurValidater onSubmitValidater regExp wml

Oracle9*i* JDeveloper BC4J/UIX Tag Library

UIX JSP pages can include both BC4J data tags and BC4J UIX convenience tags that simplify the presentation of data.

The BC4J UIX convenience tags rely on an `ApplicationModule` data tag to get the data source from the BC4J application module. In addition to the BC4J UIX tags listed here, you can use the (non-UIX) BC4J tags in UIX JSP pages.

Table 1–16 summarizes the BC4J / UIX tags. The typical tag prefix is `bc4juix`.

For more information, refer to the Oracle9*i* JDeveloper online help, or their documentation on the Oracle Technology Network:

`http://otn.oracle.com/products/jdev/content.html`

Table 1–16 Summary of BC4J/UIX Tag Library

Tag	Description	Attributes
AddTableRow	Renders a special "table row" that lets users add rows of data to the data source. The body can contain JSP content.	text rows destination
InputRender	Renders an input field from a data source to a page.	datasource dataitem
LabelStyledText	Binds styled text labels to the data source automatically.	datasource dataitem
NavigationBar	Binds the navigation bar to the data source automatically.	datasource
RenderValue	Displays data of special data types—such as images, audio, or video—using a field render specific to the data object type.	datasource dataitem
StyledText	Binds styled text to the data source automatically.	datasource dataitem styleClass accessKey destination
Table	Binds a table to the data source automatically. The body can contain JSP content.	datasource alternateText destination formSubmitted height width name nameTransformed proxied summary text value
TableDetail	Causes the detail column from the data source to be displayed. The body can contain JSP content.	(none)

Oracle9*i* Reports Tag Library

Oracle9*i* Reports tags integrate with data model objects that are used to create Oracle reports. The Reports custom tags allow you to quickly add report blocks and graphs to existing JSP files. These tags can be used as templates to enable you to build and insert your own data-driven Java component into a Reports HTML page.

An example of a custom JSP tag is the 3D Graphics charting component. Using a custom JSP tag, you can pass Reports data to the 3D application server, which creates an image of the chart. The custom JSP tag then returns HTML to reference the created image.

The `report` and `objects` tags, respectively, delimit and define the report block. Inside these tags, other custom tags define the content and the look and feel of the report data.

Table 1–17 summarizes the Reports tags. The typical tag prefix is `rw`.

For more information, refer to the Oracle9*i* Reports Developer online help, under Reference / JSP Tags. You can also find more information about Reports on the Oracle Technology Network:

`http://otn.oracle.com/products/reports/content.html`

Table 1–17 Summary of Reports Tag Library

Tag	Description	Attributes
report	Delimits a report object within a JSP page.	id parameters
objects	Modifies the report definition.	id
field	Provides formatting to render a single value source object in HTML.	id src breakLevel breakValue nullValue containsHtml formatMask formatTrigger
foreach	Loops through a data source group.	id src startRow endRow increment

Table 1–17 Summary of Reports Tag Library (Cont.)

Tag	Description	Attributes
getValue	Retrieves the name for a report object.	id src formatMask
graph	Defines a graph or chart.	id src groups dataValues series width height graphHyperlink
include	Reformats a top-level layout object into a simple HTML table.	id src format
seq	Defines a sequence of values.	name seq
seqval	Operates on a sequence of values defined by the `seq` tag.	ref op
id	Generates unique HTML IDs for row and column headers for compliance with the American Disabilities Act.	id breakLevel asArray
headers	Retrieves ID values generated by the `id` tag for row and column headers.	id src

Oracle9*i*AS Wireless Location (Spatial) Tag Library

Developers of location-based applications need specialized services for the following:

- geocoding—associating geographical coordinates with addresses
- mapping—providing a graphical map for a point, set of points, route, or driving maneuver
- routing—providing driving directions
- business directories ("yellow pages")—listing businesses by region and by either category or name
- traffic—providing information about accidents, construction, and other incidents that affect traffic flow

The Oracle9*i*AS Wireless location application components are a set of APIs for performing geocoding, providing driving directions, and looking up business directories. Service proxies are included that map existing important providers to the APIs, and additional providers are expected to be accommodated in the future.

For JSP developers, a tag library is provided, as summarized in Table 1–18. The typical tag prefix is `loc`.

For more information, refer to the *Oracle9iAS Wireless Developer's Guide*.

Table 1–18 Summary of Location (Spatial) Tag Library

Tag	Description	Attributes
address	For a geocoding, mapping, or routing application, this specifies an address to be geocoded, located on a map, or used as the start or end address of a route, or as the center for a business directory query.	name type businessName firstLine city state postalCode country
map	For a mapping application, this specifies a map with a specified resolution, showing one of the following: one or more points, a route, or a driving maneuver.	name type points route maneuver xres yres
route	For a routing application, this specifies a route with a specified map resolution. It includes maneuvers, an overview map, and maneuver maps.	name type xres yres
iterateManeuvers	For a routing application, this creates a collection of driving maneuvers, presenting the maneuvers individually.	name type routeID

Table 1–18 Summary of Location (Spatial) Tag Library (Cont.)

Tag	Description	Attributes
businesses	For a business directory application, this specifies a collection of businesses that share one or more attributes.	name type businessName categoryID keyword city state postalCode country centerID radius nearestN
iterateBusinesses	For a business directory application, this presents individually the businesses in a collection returned by the `businesses` tag.	name type collection
category	For a business directory application, this specifies a business category, such as "dealers".	name type parentCategory categoryName
iterateCategoriesMatchingKeyword	For a business directory application, this creates a collection of categories that match a specified keyword value, and presents the categories individually.	name type parentCategory keyword
iterateChildCategories	For a business directory application, this specifies a collection of immediate "child" subcategories, presented individually.	name type parentCategory

Oracle9*i*AS Ultra Search Tag Library

Oracle9*i*AS Ultra Search provides a custom tag library for use by developers in incorporating content search functionality into JSP applications. The library includes the following functionality:

- the ability to retrieve search attributes, groups, languages, and lists of values (LOVs) for rendering the advance query form

- the ability to iterate through the resulting hit set, and retrieve document attributes and properties for rendering the result page
- the ability to perform a search with "relevance boosting" and an estimation of the total hit count

The tag library is summarized in Table 1–19. The typical tag prefix is US.

For more information, see the *Oracle Ultra Search User's Guide*. Alternatively, refer to the Ultra Search online documentation, under Ultra Search JSP Tag Library.

Table 1–19 Summary of Ultra Search Tag Library

Tag	Description	Attributes
instance	This tag establishes a connection to an Ultra Search instance.	instanceId username password url dataSourceName tablePagePath emailPagePath filePagePath
iterAttributes	For an advanced query, use this tag to show the list of attributes that are available.	instance locale
iterGroups	For an advanced query, use this tag to show the list of groups that are available.	instance locale
iterLanguages	For an advanced query, use this tag to show the list of languages defined in the Ultra Search instance.	instance
iterLOV	Use this tag to show all values defined for a search attribute.	instance locale attributeName attributeType
getResult	Use this tag to perform the search.	resultId instance query queryLocale documentLanguage from to boostTerm withCount

Table 1–19 Summary of Ultra Search Tag Library (Cont.)

Tag	Description	Attributes
fetchAttribute	This is a nested tag within `getResult` to specify which attributes of each document should be fetched along with the query results. There can be multiple `fetchAttribute` tags nested inside a `getResult` tag.	attributeName attributeType
showHitCount	If `withCount="true"` in the `getResult` tag, then the result includes a total number of hits and you can use `showHitCount` to display this number.	result
iterResult	This tag iterates through all the documents in the search results. Use this to present the results in the JSP page.	result instance
showAttributeValue	Renders a document attribute.	attributeName attributeType default

Oracle9*i*AS Portal Tag Library

With Oracle9*i*AS Portal, developers can accomplish the following:

- Build and deploy Internet portals to deliver relevant information and applications to customers, employees, and partners.
- Develop portals rapidly, without code, using productive online tools.
- Increase user productivity with single sign-on and self-service publishing.
- Add value quickly with over 250 prebuilt portlets based on open standards.

The Oracle9*i*AS Portal tag library provides further convenience for developers building customizable Internet portals. A developer can create internal JSP pages, which are stored inside the Portal database and downloaded when the portal is executed, or external JSP pages, which are stored in the file system, or some combination.

The tag library is summarized in Table 1–20. The typical tag prefix is `portal`.

For more information, refer to the document *Oracle9i Application Server Portal: Adding JSPs*, available through the Oracle Technology Network:

`http://otn.oracle.com`

Table 1–20 Summary of Portal Tag Library

Tag	Description	Attributes
usePortal	Use this to specify the overall portal, which forms the framework of the Web page and contains portlets that have the dynamic content. This must be the first Portal tag in a JSP page.	id pagegroup login
prepare	Use this to set up a bundle of one or more portlets that will be displayed within the portal.	portal portletHeaders
portlet	Use one or more of these tags inside a prepare tag to declare the portlets to be displayed.	id instance header
showPortlet	Use this to display a portlet—typically, but not necessarily, a portlet that was declared through a portlet tag. In its simplest usage, however, the showPortlet tag itself specifies the portlet to display.	name portal header
parameter	Use this inside a portlet or showPortlet tag to specify a parameter setting for a portlet. (For example, for a stock-quote portlet, specify the stock to quote.)	name value
useStyle	Specify a CSS style to use for the portal, or use the default style. (Alternatively, do not use this tag at all and implement the desired style by other means.)	name portal

2

JavaBeans for Extended Types

This chapter describes JavaBeans provided with OC4J for use as extended types. For JSP pages, these types offer advantages over Java primitive types or standard `java.lang` types.

The chapter consists of the following:

Overview of JML Extended Types

JSP pages generally rely on core Java types in representing scalar values. However, neither of the following type categories is fully suitable for use in JSP pages:

- primitive types such as `int`, `float`, and `double`

  Values of these types cannot have a specified scope—they cannot be stored in a JSP scope object (for `page`, `request`, `session`, or `application` scope), because only objects can be stored in a scope object.

- wrapper classes in the standard `java.lang` package, such as `Integer`, `Float`, and `Double`

  Values of these types are objects, so they can theoretically be stored in a JSP scope object. However, they cannot be declared in a `jsp:useBean` action, because the wrapper classes do not follow the JavaBean model and do not provide zero-argument constructors.

  Additionally, instances of the wrapper classes are immutable. To change a value, you must create a new instance and assign it appropriately.

To work around these limitations, OC4J provides the following JavaBean classes in the `oracle.jsp.jml` package to act as wrappers for the most common Java types:

- `JmlBoolean` to represent a `boolean` value
- `JmlNumber` to represent an `int` value
- `JmlFPNumber` to represent a `double` value
- `JmlString` to represent a `String` value

Each of these classes has a single attribute, `value`, and includes methods to get the value, set the value from input in various formats, test whether the value is equal to a value specified in any of several formats, and convert the value to a string.

Alternatively, instead of using the `getValue()` and `setValue()` methods, you can use the `jsp:getProperty` and `jsp:setProperty` tags, as with any other bean.

The following example creates a `JmlNumber` instance called `count` that has `application` scope:

```
<jsp:useBean id="count" class="oracle.jsp.jml.JmlNumber" scope="application" />
```

Later, assuming that the value has been set elsewhere, you can access it as follows:

```
<h3> The current count is <%=count.getValue() %> </h3>
```

The following example creates a `JmlNumber` instance called `maxSize` that has `request` scope, and sets it using `setProperty`:

```
<jsp:useBean id="maxSize" class="oracle.jsp.jml.JmlNumber" scope="request" >
    <jsp:setProperty name="maxSize" property="value" value="<%= 25 %>" />
</jsp:useBean>
```

JML Extended Type Descriptions

This section documents public methods of the four extended types—`JmlBoolean`, `JmlNumber`, `JmlFPNumber`, and `JmlString`—followed by an example.

Note: To use the JML extended types, verify that the `ojsputil.jar` file is installed and in your classpath. This file is supplied with OC4J.

Type JmlBoolean

A `JmlBoolean` object represents a Java `boolean` value.

The `getValue()` and `setValue()` methods get or set the `value` property of the bean as a Java `boolean` value.

- `boolean getValue()`
- `void setValue(boolean)`

The `setTypedValue()` method has several signatures and can set the `value` property from a string (such as "`true`" or "`false`"), a `java.lang.Boolean` value, a Java `boolean` value, or a `JmlBoolean` value. For the string input, conversion of the string is performed according to the same rules as for the `valueOf()` method of the `java.lang.Boolean` class.

- `void setTypedValue(String)`
- `void setTypedValue(Boolean)`
- `void setTypedValue(boolean)`
- `void setTypedValue(JmlBoolean)`

The `equals()` method tests whether the `value` property is equal to the specified Java `boolean` value.

- `boolean equals(boolean)`

The `typedEquals()` method has several signatures and tests whether the `value` property has a value equivalent to a specified string (such as "`true`" or "`false`"), `java.lang.Boolean` value, or `JmlBoolean` value.

- `boolean typedEquals(String)`
- `boolean typedEquals(Boolean)`
- `boolean typedEquals(JmlBoolean)`

The `toString()` method returns the `value` property as a `java.lang.String` value, either "`true`" or "`false`".

- `String toString()`

Type JmlNumber

A `JmlNumber` object represents a 32-bit number equivalent to a Java `int` value.

The `getValue()` and `setValue()` methods get or set the `value` property of the bean as a Java `int` value.

- `int getValue()`
- `void setValue(int)`

The `setTypedValue()` method has several signatures and can set the `value` property from a string, a `java.lang.Integer` value, a Java `int` value, or a `JmlNumber` value. For the string input, conversion of the string is performed according to the same rules as for the `decode()` method of the `java.lang.Integer` class.

- `void setTypedValue(String)`
- `void setTypedValue(Integer)`
- `void setTypedValue(int)`
- `void setTypedValue(JmlNumber)`

The `equals()` method tests whether the `value` property is equal to the specified Java `int` value.

- `boolean equals(int)`

The `typedEquals()` method has several signatures and tests whether the `value` property has a value equivalent to a specified string (such as "`1234`"), `java.lang.Integer` value, or `JmlNumber` value.

- `boolean typedEquals(String)`
- `boolean typedEquals(Integer)`
- `boolean typedEquals(JmlNumber)`

The `toString()` method returns the `value` property as an equivalent `java.lang.String` value (such as "`1234`"). This method has the same functionality as the `toString()` method of the `java.lang.Integer` class.

- `String toString()`

Type JmlFPNumber

A `JmlFPNumber` object represents a 64-bit floating point number equivalent to a Java `double` value.

The `getValue()` and `setValue()` methods get or set the `value` property of the bean as a Java `double` value.

- `double getValue()`
- `void setValue(double)`

The `setTypedValue()` method has several signatures and can set the `value` property from a string (such as "`3.57`"), a `java.lang.Integer` value, a Java `int` value, a `java.lang.Float` value, a Java `float` value, a `java.lang.Double` value, a Java `double` value, or a `JmlFPNumber` value. For the string input, conversion of the string is according to the same rules as for the `valueOf()` method of the `java.lang.Double` class.

- `void setTypedValue(String)`
- `void setTypedValue(Integer)`
- `void setTypedValue(int)`
- `void setTypedValue(Float)`
- `void setTypedValue(float)`
- `void setTypedValue(Double)`
- `void setTypedValue(double)`
- `void setTypedValue(JmlFPNumber)`

The `equals()` method tests whether the `value` property is equal to the specified Java `double` value.

- `boolean equals(double)`

The `typedEquals()` method has several signatures and tests whether the `value` property has a value equivalent to a specified string (such as "`3.57`"), `java.lang.Integer` value, Java `int` value, `java.lang.Float` value, Java `float` value, `java.lang.Double` value, Java `double` value, or `JmlFPNumber` value.

- `boolean typedEquals(String)`
- `boolean typedEquals(Integer)`
- `boolean typedEquals(int)`

- `boolean typedEquals(Float)`
- `boolean typedEquals(float)`
- `boolean typedEquals(Double)`
- `boolean typedEquals(JmlFPNumber)`

The `toString()` method returns the `value` property as a `java.lang.String` value (such as "`3.57`"). This method has the same functionality as the `toString()` method of the `java.lang.Double` class.

- `String toString()`

Type JmlString

A `JmlString` object represents a `java.lang.String` value.

The `getValue()` and `setValue()` methods get or set the `value` property of the bean as a `java.lang.String` value. If the input in a `setValue()` call is null, then the `value` property is set to an empty (zero-length) string.

- `String getValue()`
- `void setValue(String)`

The `toString()` method is functionally equivalent to the `getValue()` method.

- `String toString()`

The `setTypedValue()` method sets the `value` property according to the specified `JmlString` value. If the `JmlString` value is null, then the `value` property is set to an empty (zero-length) string.

- `void setTypedValue(JmlString)`

The `isEmpty()` method tests whether the `value` property is an empty (zero-length) string: ""

- `boolean isEmpty()`

The `equals()` method has two signatures and tests whether the `value` property is equal to a specified `java.lang.String` value or `JmlString` value.

- `boolean equals(String)`
- `boolean equals(JmlString)`

JML Extended Types Example

This example illustrates the use of JML extended type JavaBeans for management of simple types at scope. The page declares four session objects—one for each JML type. The page presents a form that enables you to enter values for each of these types. Once new values are submitted, the form displays both the new values and the previously set values. In the process of generating this output, the page updates the session objects with the new form values.

```
<jsp:useBean id = "submitCount" class = "oracle.jsp.jml.JmlNumber" scope = "session" />

<jsp:useBean id = "bool" class = "oracle.jsp.jml.JmlBoolean" scope = "session" >
        <jsp:setProperty name = "bool" property = "value" param = "fBoolean" />
</jsp:useBean>

<jsp:useBean id = "num" class = "oracle.jsp.jml.JmlNumber" scope = "session" >
        <jsp:setProperty name = "num" property = "value" param = "fNumber" />
</jsp:useBean>

<jsp:useBean id = "fpnum" class = "oracle.jsp.jml.JmlFPNumber" scope = "session" >
        <jsp:setProperty name = "fpnum" property = "value" param = "fFPNumber" />
</jsp:useBean>

<jsp:useBean id = "str" class = "oracle.jsp.jml.JmlString" scope = "session" >
        <jsp:setProperty name = "str" property = "value" param = "fString" />
</jsp:useBean>


<HTML>

<HEAD>
        <META HTTP-EQUIV="Content-Type" CONTENT="text/html;CHARSET=iso-8859-1">
        <META NAME="GENERATOR" Content="Visual Page 1.1 for Windows">
        <TITLE>Extended Datatypes Sample</TITLE>
</HEAD>

<BODY BACKGROUND="images/bg.gif" BGCOLOR="#FFFFFF">

<% if (submitCount.getValue() > 1) { %>
        <h3> Last submitted values </h3>
        <ul>
                <li> bool: <%= bool.getValue() %>
                <li> num: <%= num.getValue() %>
                <li> fpnum: <%= fpnum.getValue() %>
                <li> string: <%= str.getValue() %>
```

```
        </ul>
<% }

   if (submitCount.getValue() > 0) { %>

        <jsp:setProperty name = "bool" property = "value" param = "fBoolean" />
        <jsp:setProperty name = "num" property = "value" param = "fNumber" />
        <jsp:setProperty name = "fpnum" property = "value" param = "fFPNumber" />
        <jsp:setProperty name = "str" property = "value" param = "fString" />

        <h3> New submitted values </h3>
        <ul>
                <li> bool: <jsp:getProperty name="bool" property="value" />
                <li> num: <jsp:getProperty name="num" property="value" />
                <li> fpnum: <jsp:getProperty name="fpnum" property="value" />
                <li> string: <jsp:getProperty name="str" property="value" />
        </ul>
<% } %>

<jsp:setProperty name = "submitCount" property = "value" value = "<%= submitCount.getValue() + 1
%>" />

<FORM ACTION="index.jsp" METHOD="POST" ENCTYPE="application/x-www-form-urlencoded">
<P> <pre>
 boolean test: <INPUT TYPE="text" NAME="fBoolean" VALUE="<%= bool.getValue() %>" >
  number test: <INPUT TYPE="text" NAME="fNumber" VALUE="<%= num.getValue() %>" >
fpnumber test: <INPUT TYPE="text" NAME="fFPNumber" VALUE="<%= fpnum.getValue() %>" >
  string test: <INPUT TYPE="text" NAME="fString" VALUE= "<%= str.getValue() %>" >
</pre>

<P> <INPUT TYPE="submit">

</FORM>

</BODY>

</HTML>
```

3

JSP Markup Language Tags

This chapter documents the Oracle JSP Markup Language (JML) tag library, which provides a set of JSP tags to allow developers to script JSP pages without using Java statements. The JML library provides tags for variable declarations, control flow, conditional branches, iterative loops, parameter settings, and calls to objects.

The chapter is organized as follows:

Note: The library described here, which uses a standard runtime implementation, is also supported through an Oracle-specific compile-time implementation. The compile-time syntax and tags are documented in Appendix A, "JML Compile-Time Syntax and Tags". General considerations in using compile-time tags instead of runtime tags are discussed in the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

Overview of the JSP Markup Language (JML) Tag Library

OC4J supplies the JSP Markup Language (JML) tag library, developed according to JSP standards. JML tags, as with those of any standard tag library, are completely compatible with regular JSP script and can be used in any JSP page.

JML tags are intended to simplify coding syntax for JSP developers who are not proficient with Java. There are two main categories of JML tags: 1) logic / flow control; 2) bean binding.

This section covers the following topics:

- JML Tag Library Philosophy
- JML Tag Categories

Note the following requirements for using JML tags:

- Verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with the OC4J installation.
- To use the JML tag library, the tag library descriptor file, `jml.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Note: The custom JML tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

JML Tag Library Philosophy

JavaServer Pages technology is intended for two separate developer communities:

- those whose primary skill is Java programming
- those whose primary skill is in designing static content, particularly in HTML, and who may have limited scripting experience

The JML tag library is designed to allow most Web developers, with little or no knowledge of Java, to assemble JSP applications with a full complement of program flow-control features.

This model presumes that the business logic is contained in JavaBeans that are developed separately by a Java developer.

JML Tag Categories

The JML tag library covers a feature set split into two functional categories, as summarized in Table 3–1.

Table 3–1 JML Tag Functional Categories

Tag Categories	Functionality	Tags
bean binding tags	The purpose of these tags is to declare or undeclare a JavaBean at a specified JSP scope. See "Bean Binding Tag Descriptions" on page 3-4.	useVariable useForm useCookie remove
logic/flow control tags	These tags offer simplified syntax to define code flow, such as for iterative loops or conditional branches. See "Logic and Flow Control Tag Descriptions" on page 3-8.	if choose..when..[otherwise] foreach return flush

JSP Markup Language (JML) Tag Descriptions

This section documents the JML tags that are supported in the current JSP runtime implementation. They are categorized as follows:

- Bean Binding Tag Descriptions
- Logic and Flow Control Tag Descriptions

For an elementary sample using some of the tags described here, refer to the OC4J demos.

Notes:

- The prefix "jml:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

Bean Binding Tag Descriptions

This section documents the following JML tags, which are used for bean-binding operations:

- JML useVariable Tag
- JML useForm Tag
- JML useCookie Tag
- JML remove Tag

JML useVariable Tag

This tag offers a convenient alternative to the `jsp:useBean` tag for declaring simple variables.

Syntax

```
<jml:useVariable id = "beanInstanceName"
             [ scope = "page" | "request" | "session" | "application" ]
               type = "string" | "boolean" | "number" | "fpnumber"
             [ value = "stringLiteral" ] />
```

Attributes

- `id` (required)—Names the variable being declared.
- `scope`—Defines the duration or scope of the variable (as with a `jsp:useBean` tag). The default scope is `page`.
- `type` (required)—Specifies the type of the variable. Type specifications refer to `JmlString`, `JmlBoolean`, `JmlNumber`, or `JmlFPNumber`.
- `value`—Allows the variable to be set directly in the declaration, as either a string literal or a JSP expression enclosed in `<%=... %>` syntax. If this attribute is not specified, then the value remains the same as when it was last set (if it already exists) or is initialized with a default value. If it is specified, then the value is always set, regardless of whether this declaration instantiates the object or merely acquires it from the named scope.

Example Consider the following example:

```
<jml:useVariable id = "isValidUser" type = "boolean" value = "<%= dbConn.isValid() %>" scope = "session" />
```

This is equivalent to the following:

```
<jsp:useBean id = "isValidUser" class = "oracle.jsp.jml.JmlBoolean" scope = "session" />
<jsp:setProperty name="isValidUser" property="value" value = "<%= dbConn.isValid() %>" />
```

JML useForm Tag

This tag provides a convenient syntax for declaring variables and setting them to values passed in from the request.

Syntax

```
<jml:useForm id = "beanInstanceName"
           [ scope = "page" | "request" | "session" | "application" ]
           [ type = "string" | "boolean" | "number" | "fpnumber" ]
             param = "requestParameterName" />
```

Attributes

- `id` (required)—Names the variable being declared or referenced.
- `scope`—Defines the duration or scope of the variable (as with a `jsp:useBean` tag). The default is "`page`".

- type—Specifies the type of the variable. Type specifications refer to JmlString, JmlBoolean, JmlNumber, or JmlFPNumber. The default is "string".
- param (required)—Specifies the name of the request parameter whose value is used in setting the variable. If the request parameter exists, then the variable value is always updated, regardless of whether this declaration brings the variable into existence. If the request parameter does not exist, then the variable value remains unchanged.

Example The following example sets a session variable named user of the type string to the value of the request parameter named user.

```
<jml:useForm id = "user" type = "string" param = "user" scope = "session" />
```

This is equivalent to the following:

```
<jsp:useBean id = "user" class = "oracle.jsp.jml.JmlString" scope = "session" />
<jsp:setProperty name="user" property="value" param = "user" />
```

JML useCookie Tag

This tag offers a convenient syntax for declaring variables and setting them to values contained in cookies.

Syntax

```
<jml:useCookie id = "beanInstanceName"
            [ scope = "page" | "request" | "session" | "application" ]
            [ type = "string" | "boolean" | "number" | "fpnumber" ]
              cookie = "cookieName" />
```

Attributes

- id (required)—Names the variable being declared or referenced.
- scope—Defines the duration or scope of the variable. This attribute is optional; the default is "page".
- type—Identifies the type of the variable. Type specifications refer to JmlString, JmlBoolean, JmlNumber, or JmlFPNumber. The default is "string".
- cookie (required)—Specifies the name of the cookie whose value is used in setting this variable. If the cookie exists, then the variable value is always

updated, regardless of whether this declaration brings the variable into existence. If the cookie does not exist, then the variable value remains unchanged.

Example The following example sets a request variable named `user` of the type `string` to the value of the cookie named `user`.

```
<jml:useCookie id = "user" type = "string" cookie = "user" scope = "request" />
```

This is equivalent to the following:

```
<jsp:useBean id = "user" class = "oracle.jsp.jml.JmlString" scope = "request" />
<%
     Cookies [] cookies = request.getCookies();
     for (int i = 0; i < cookies.length; i++) {
             if (cookies[i].getName().equals("user")) {
                     user.setValue(cookies[i].getValue());
                     break;
             }
     }
%>
```

JML remove Tag

This tag removes an object (typically a bean) from its scope.

Syntax

```
<jml:remove id = "beanInstanceName"
          [ scope = "page" | "request" | "session" | "application" ] />
```

Attributes

- `id` (required)—Specifies the name of the bean being removed.
- `scope`—Specifies the scope of the bean being removed. If not specified, then scopes are searched in the following order: 1) `page`, 2) `request`, 3) `session`, 4) `application`. The first object whose name matches `id` is removed.

Example The following example removes the session `user` object:

```
<jml:remove id = "user" scope = "session" />
```

This is equivalent to the following:

```
<% session.removeValue("user"); %>
```

Logic and Flow Control Tag Descriptions

This section documents the following JML tags, which are used for logic and flow control:

- JML if Tag
- JML choose...when...[otherwise] Tags
- JML for Tag
- JML foreach Tag
- JML return Tag
- JML flush Tag

These tags, which are intended for developers without extensive Java experience, can be used in place of Java logic and flow control syntax, such as iterative loops and conditional branches.

JML if Tag

This tag evaluates a single conditional statement. If the condition is true, then the body of the `if` tag is executed.

Syntax

```
<jml:if condition = "<%= jspExpression %>" >
     ...body of if tag (executed if the condition is true)...
</jml:if>
```

Attributes

- `condition` (required)—Specifies the conditional expression to be evaluated.

Example The following e-commerce example displays information from a user's shopping cart. The code checks to see if the variable holding the current T-shirt order is empty. If not, then the size that the user has ordered is displayed. Assume `currTS` is of type `JmlString`.

```
<jml:if condition = "<%= !currTS.isEmpty() %>" >
     <S>(size: <%= currTS.getValue().toUpperCase() %>)</S> 
</jml:if>
```

JML choose...when...[otherwise] Tags

The `choose` tag, with associated `when` and `otherwise` tags, provides a multiple conditional statement.

The body of the `choose` tag contains one or more `when` tags, where each `when` tag represents a condition. For the first `when` condition that is true, the body of that `when` tag is executed. (A maximum of one `when` body is executed.)

If none of the `when` conditions are true, and if the optional `otherwise` tag is specified, then the body of the `otherwise` tag is executed.

Syntax

```
<jml:choose>
    <jml:when condition = "<%= jspExpression %>" >
        ...body of 1st when tag (executed if the condition is true)...
    </jml:when>
    ...
    [...optional additional when tags...]
    [ <jml:otherwise>
        ...body of otherwise tag (executed if all when conditions false)...
    </jml:otherwise> ]
</jml:choose>
```

Attributes The `when` tag uses the following attribute:

- `condition` (required)—Specifies the conditional expression to be evaluated.

The `choose` and `otherwise` tags have no attributes.

Example The following e-commerce example displays information from a user's shopping cart. This code checks to see if anything has been ordered. If so, the current order is displayed; otherwise, the user is asked to shop again. (This example omits the code to display the current order.) Presume `orderedItem` is of the type `JmlBoolean`.

```
<jml:choose>
     <jml:when condition = "<%= orderedItem.getValue() %>"  >
          You have changed your order:
```

```
            -- output the current order --
     </jml:when>
     <jml:otherwise>
          Are you sure we can't interest you in something, cheapskate?
     </jml:otherwise>
</jml:choose>
```

JML for Tag

This tag provides the ability to iterate through a loop, as with a Java `for` loop.

The `id` attribute is a local loop variable of the type `java.lang.Integer` that contains the value of the current range element. The range starts at the value expressed in the `from` attribute and is incremented by one after each execution of the body of the loop, until it exceeds the value expressed in the `to` attribute.

Once the range has been traversed, control goes to the first statement following the `for` end-tag.

> **Note:** Descending ranges are not supported—the `from` value must be less than or equal to the `to` value.

Syntax

```
<jml:for id = "loopVariable"
         from = "<%= jspExpression %>"
         to = "<%= jspExpression %>" >
      ...body of for tag (executed once at each value of range, inclusive)...
</jml:for>
```

Attributes

- `id` (required)—This is the name of the loop variable, which holds the current value in the range. This is a `java.lang.Integer` value and can be used only within the body of the tag.
- `from` (required)—Specifies the start of the range. This is an expression that must evaluate to a Java `int` value.
- `to` (required)—Specifies the end of the range. This is an expression that must evaluate to a Java `int` value.

Example The following example repeatedly prints "Hello World" in progressively smaller headings (H1, H2, H3, H4, H5).

```
<jml:for id="i" from="<%= 1 %>" to="<%= 5 %>" >
     <H<%=i%>>
            Hello World!
     </H<%=i%>>
</jml:for>
```

JML foreach Tag

This tag provides the ability to iterate over a homogeneous set of values.

The body of the tag is executed once for each element in the set. If the set is empty, then the body is not executed.

The `id` attribute is a local loop variable containing the value of the current set element. Its type is specified in the `type` attribute. (The specified type should match the type of the set elements, as applicable.)

This tag currently supports iterations over the following types of data structures:

- Java array
- `java.util.Enumeration`
- `java.util.Vector`

Syntax

```
<jml:foreach id = "loopVariable"
             in = "<%= jspExpression %>"
             limit = "<%= jspExpression %>"
             type = "package.class" >
    ...body of foreach tag (executes once for each element in data structure)...
</jml:foreach>
```

Attributes

- `id` (required)—This is the name of the loop variable, which holds the value of the current element at each step of the iteration. It can be used only within the body of the tag. Its type is the same as specified in the `type` attribute.
- `in` (required)—Specifies a JSP expression that evaluates to a Java array, `Enumeration` object, or `Vector` object.

- `limit` (required)—Specifies a JSP expression that evaluates to a Java `int` value defining the maximum number of iterations, regardless of the number of elements in the set.
- `type` (required)—Specifies the type of the loop variable. This should match the type of the set elements, as applicable.

Example The following example iterates over the request parameters.

```
<jml:foreach id="name" in="<%= request.getParameterNames() %>" type="java.lang.String" >
    Parameter: <%= name %>
    Value: <%= request.getParameter(name) %> <br>
</jml:foreach>
```

or, if you want to handle parameters with multiple values:

```
<jml:foreach id="name" in="<%= request.getParameterNames() %>" type="java.lang.String" >
    Parameter: <%= name %>
    Value: <jml:foreach id="val" in="<%=request.getParameterValues(name)%>"
                        type="java.lang.String" >
                <%= val %> :
           </jml:foreach>
    <br>
</jml:foreach>
```

JML return Tag

When this tag is reached, execution returns from the page without further processing.

Syntax

```
<jml:return />
```

Attributes

None.

Example The following example returns without processing the page if the timer has expired.

```
<jml:if condition="<%= timer.isExpired() %>" >
     You did not complete in time!
     <jml:return />
</jml:if>
```

JML flush Tag

This tag writes the current contents of the page buffer back to the client. This applies only if the page is buffered; otherwise, there is no effect.

Syntax

```
<jml:flush />
```

Attributes

None.

Example The following example flushes the current page contents before performing an expensive operation.

```
<jml:flush />
<% myBean.expensiveOperation(out); %>
```

4

Data-Access JavaBeans and Tags

This chapter describes JavaBeans and tags provided with OC4J for use in accessing a database from servlets and JSP pages.

The chapter is organized as follows:

JavaBeans for Data Access

The OC4J product includes a set of JavaBeans you can use to access a database. This section, organized as follows, describes the beans:

- Introduction to Data-Access JavaBeans
- Data-Access Support for Data Sources and Pooled Connections
- Data-Access JavaBean Descriptions

Note: The JavaBeans described here are used by the tags discussed in "SQL Tags for Data Access" on page 4-16. Generally speaking, these beans and tags can be used with non-Oracle databases, assuming you have appropriate JDBC driver classes; however, numerous features described below, as noted, are Oracle-specific.

Introduction to Data-Access JavaBeans

OC4J supplies a set of custom JavaBeans for database access. The following beans are included in the `oracle.jsp.dbutil` package:

- `ConnBean` opens a database connection. This bean also supports data sources and connection pooling. See "Data-Access Support for Data Sources and Pooled Connections" on page 4-3 for related information.
- `ConnCacheBean` uses the Oracle JDBC connection caching implementation for database connections. This requires JDBC 2.0.
- `DBBean` executes a database query. It also has its own connection mechanism, but does not support data sources.
- `CursorBean` provides general DML support for queries; `UPDATE`, `INSERT`, and `DELETE` statements; and stored procedure calls.

This section presumes a working knowledge of Oracle JDBC. Consult the *Oracle9i JDBC Developer's Guide and Reference* as necessary.

To use the data-access JavaBeans, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with the OC4J installation. For XML-related methods and functionality, you will also need the file `xsu12.jar` (for JDK 1.2.x) or `xsu111.jar` (for JDK 1.1.x), both of which are provided with Oracle9*i*AS.

You will also need appropriate JDBC driver classes installed and in your classpath, such as `classes12.zip` for an Oracle database and JDK 1.2 or higher.

Notes: The Oracle data-access JavaBeans implement the Oracle `JspScopeListener` interface for event notification. Refer to "JSP Event-Handling with JspScopeListener" on page 8-2 for information about this interface.

Data-Access Support for Data Sources and Pooled Connections

The data-access JavaBeans, as well as the data-access tag library, supports the use of data sources to specify connection properties. This is also how support for connection pooling is implemented. This mechanism supports both Oracle connection objects and OC4J connection objects.

To use a data source in a JSP page, you must define the data source, its JNDI name, and its connection and pooling properties. In OC4J, do this in a `<data-source>` element in the `data-sources.xml` file. Here is an example:

```
<data-source
   class="oracle.jdbc.pool.OracleDataSource"
   name="jdbc/ejbpool/OracleDS"
   location="jdbc/ConnectionDS"
   ejb-location="jdbc/ejbpool/OracleDS"
   url="jdbc:oracle:thin:@myhost:1521:orcl"
   username="scott"
   password="tiger"
   min-connections="3"
   max-connections="50"
   wait-timeout="10"
   inactivity-timeout="30" />
```

See the *Oracle9iAS Containers for J2EE Services Guide* for more information about data sources.

Data-Access JavaBean Descriptions

This section describes attributes and methods of the data-access JavaBeans—`ConnBean`, `ConnCacheBean`, `DBBean`, and `CursorBean`—and concludes with an example that uses a data source:

- ConnBean for a Database Connection

ConnBean for a Database Connection

Use `oracle.jsp.dbutil.ConnBean` to establish a simple database connection (one that uses no connection pooling or caching).

> **Note:** For queries only, if you do not require a data source, it is simpler to use `DBBean`, which has its own connection mechanism.

`ConnBean` has the following properties. The `user`, `password`, and `URL` properties are not required if you use a data source.

- `dataSource` (JNDI name for a data source location)

  This is valid only for an environment that supports data sources. See "Data-Access Support for Data Sources and Pooled Connections" on page 4-3 for information about how to set up a data source in OC4J.
- `user` (user ID for database schema)
- `password` (user password)
- `URL` (database connection string)
- `stmtCacheSize` (cache size for Oracle JDBC statement caching)

  Setting `stmtCacheSize` enables Oracle JDBC statement caching.
- `executeBatch` (batch size for Oracle JDBC update batching)

  Setting `executeBatch` enables Oracle JDBC update batching.
- `preFetch` (number of statements to prefetch in Oracle JDBC row prefetching)

  Setting `preFetch` enables Oracle JDBC row prefetching.
- `commitOnClose` ("`true`" or "`false`" to execute `commit` when connection is closed)

  The value of this property indicates whether an automatic `commit` should be executed when the connection is closed. A "`true`" setting results in a `commit`; a

"false" setting results in a rollback. In previous releases, an automatic commit was always executed, but in Oracle9*i*AS release 2 the default is an automatic rollback. The commitOnClose property allows for backward compatibility to ease migration.

Be aware that there can be an application-wide commit-on-close setting in the application web.xml file, but the setting of the ConnBean property is not automatically dependent on that setting. If a JSP pages uses ConnBean instead of a dbOpen tag, the value of the commit-on-close context parameter should be retrieved and then explicitly set as the commitOnClose value in the ConnBean instance. For reference, here is a sample web.xml entry that sets the commit-on-close context parameter:

```
<context-param>
   <param-name>commit-on-close</param-name>
   <param-value>true</param-value>
</context-param>
```

Note: See the *Oracle9i JDBC Developer's Guide and Reference* for information about statement caching, update batching, and row prefetching.

ConnBean provides the following setter and getter methods for these properties:

- void setDataSource(String)
- String getDataSource()
- void setUser(String)
- String getUser()
- void setPassword(String)
- String getPassword()
- void setURL(String)
- String getURL()
- void setStmtCacheSize(int)
- int getStmtCacheSize()
- void setExecuteBatch(int)

- `int getExecuteBatch()`
- `void setPreFetch(int)`
- `int getPreFetch()`
- `void setCommitOnClose(String)`
- `String getCommitOnClose()`

> **Note:** As with any JavaBean you use in a JSP page, you can set any of the `ConnBean` properties with a `jsp:setProperty` action instead of using the setter method directly.

Use the following methods to open and close a connection, or to verify its status:

- `void connect()`

  Establish a database connection using `ConnBean` property settings.

- `void close()`

  Close the connection and any open cursors.

- `boolean isConnectionClosed()`—Determine if the connection is closed.

Use the following method to open a cursor and return a `CursorBean` object:

- `CursorBean getCursorBean(int, String)`

or:

- `CursorBean getCursorBean(int)`

  Input the following:

  – one of the following `int` constants to specify the type of JDBC statement you want: `CursorBean.PLAIN_STMT` for a `Statement` object, `CursorBean.PREP_STMT` for a `PreparedStatement` object, or `CursorBean.CALL_STMT` for a `CallableStatement` object

  – a string specifying the SQL operation to execute (optional)

  Alternatively, you can specify the SQL operation in the `CursorBean` method call that executes the statement.

See "CursorBean for DML and Stored Procedures" on page 4-11 for information about `CursorBean` functionality.

ConnCacheBean for Connection Caching

Use `oracle.jsp.dbutil.ConnCacheBean` to use the Oracle JDBC connection caching mechanism, using JDBC 2.0 connection pooling, for your database connections. Refer to the *Oracle9i JDBC Developer's Guide and Reference* for information about connection caching.

Notes:

- To use data sources or simple connection objects, use `ConnBean` instead.
- `ConnCacheBean` extends `OracleConnectionCacheImpl`, which extends `OracleDataSource` (both in Oracle JDBC package `oracle.jdbc.pool`).

`ConnCacheBean` has the following properties:

- `user` (user ID for database schema)
- `password` (user password)
- `URL` (database connection string)
- `maxLimit` (maximum number of connections allowed by this cache)
- `minLimit` (minimum number of connections existing for this cache)

  If you use fewer than this number, then there will also be connections in the idle pool of the cache.
- `stmtCacheSize` (cache size for Oracle JDBC statement caching)

  Setting `stmtCacheSize` enables the Oracle JDBC statement caching feature. Refer to the *Oracle9i JDBC Developer's Guide and Reference* for information about Oracle JDBC statement caching features and limitations.
- `cacheScheme` (type of cache, indicated by one of the following `int` constants):
  - `DYNAMIC_SCHEME`—New pooled connections can be created above and beyond the maximum limit, but each one is automatically closed and freed as soon as the logical connection instance that it provided is no longer in use.
  - `FIXED_WAIT_SCHEME`—When the maximum limit is reached, any new connection waits for an existing connection object to be released.

  - FIXED_RETURN_NULL_SCHEME—When the maximum limit is reached, any new connection fails (with `null` returned) until connection objects have been released.

The `ConnCacheBean` class supports methods defined in the Oracle JDBC `OracleConnectionCacheImpl` class, including the following getter and setter methods for its properties:

- `void setUser(String)`
- `String getUser()`
- `void setPassword(String)`
- `String getPassword()`
- `void setURL(String)`
- `String getURL()`
- `void setMaxLimit(int)`
- `int getMaxLimit()`
- `void setMinLimit(int)`
- `int getMinLimit()`
- `void setStmtCacheSize(int)`
- `int getStmtCacheSize()`
- `void setCacheScheme(int)`

  Specify `ConnCacheBean.DYNAMIC_SCHEME`, `ConnCacheBean.FIXED_WAIT_SCHEME`, or `ConnCacheBean.FIXED_RETURN_NULL_SCHEME`.

- `int getCacheScheme()`

  Returns `ConnCacheBean.DYNAMIC_SCHEME`, `ConnCacheBean.FIXED_WAIT_SCHEME`, or `ConnCacheBean.FIXED_RETURN_NULL_SCHEME`.

The `ConnCacheBean` class also inherits properties and related getter and setter methods from the `oracle.jdbc.pool.OracleDataSource` class. This provides getter and setter methods for the following properties: `databaseName`, `dataSourceName`, `description`, `networkProtocol`, `portNumber`, `serverName`, and `driverType`. For information about these properties and their getter and setter methods, see the *Oracle9i JDBC Developer's Guide and Reference*.

Note: As with any JavaBean you use in a JSP page, you can set any of the `ConnCacheBean` properties with a `jsp:setProperty` action instead of using the setter method directly.

Use the following methods to open and close a connection:

- `Connection getConnection()`

  Get a connection from the connection cache using `ConnCacheBean` property settings.

- `void close()`

  Close all connections and any open cursors.

Although the `ConnCacheBean` class does not support Oracle JDBC update batching and row prefetching directly, you can enable these features by calling the `setDefaultExecuteBatch(int)` and `setDefaultRowPrefetch(int)` methods of the `Connection` object that you retrieve from the `getConnection()` method. Alternatively, you can use the `setExecuteBatch(int)` and `setRowPrefetch(int)` methods of JDBC statement objects that you create from the `Connection` object. (Update batching is supported only in prepared statements.) Refer to the *Oracle9i JDBC Developer's Guide and Reference* for information about these features.

Notes:

- `ConnCacheBean` has the same functionality as the `OracleConnectionCacheImpl` class. See the *Oracle9i JDBC Developer's Guide and Reference* for more information.
- Unlike `ConnBean`, when you use `ConnCacheBean`, use normal `Connection` object functionality to create and execute statement objects.

DBBean for Queries Only

Use `oracle.jsp.dbutil.DBBean` to execute queries only.

Notes:

- `DBBean` has its own connection mechanism but does not support data sources. If you require a data source, use `ConnBean` instead.
- Use `CursorBean` for any other DML operations (`UPDATE`, `INSERT`, `DELETE`, or stored procedure calls).

`DBBean` has the following properties:

- `user` (user ID for database schema)
- `password` (user password)
- `URL` (database connection string)

`DBBean` provides the following setter and getter methods for these properties:

- `void setUser(String)`
- `String getUser()`
- `void setPassword(String)`
- `String getPassword()`
- `void setURL(String)`
- `String getURL()`

Note: As with any JavaBean you use in a JSP page, you can set any of the `DBBean` properties with a `jsp:setProperty` statement instead of using the setter method directly.

Use the following methods to open and close a connection:

- `void connect()`

  Establish a database connection using `DBBean` property settings.

- `void close()`

  Close the connection and any open cursors.

Use either of the following methods to execute a query:

- `String getResultAsHTMLTable(String)`

  Input a string that contains the `SELECT` statement. This method returns a string with the HTML commands necessary to output the result set as an HTML table. SQL column names (or aliases) are used for the table column headers.

- `String getResultAsXMLString(String)`

  Input a string with the `SELECT` statement. This method returns the result set as an XML string, using SQL names (or aliases) for the XML tags.

CursorBean for DML and Stored Procedures

Use `oracle.jsp.dbutil.CursorBean` for `SELECT`, `UPDATE`, `INSERT`, or `DELETE` operations or stored procedure calls on a simple connection. It uses a previously defined `ConnBean` object for the connection.

You can specify a SQL operation in a `ConnBean` object `getCursorBean()` call, or through a call to one of the `create()`, `execute()`, or `executeQuery()` methods of a `CursorBean` object as described below.

`CursorBean` supports scrollable and updatable cursors, update batching, row prefetching, and query timeout limits. For information about these Oracle JDBC features, see the *Oracle9i JDBC Developer's Guide and Reference*.

Note: To use connection caching, use `ConnCacheBean` and normal `Connection` object functionality. Do not use `CursorBean`.

`CursorBean` has the following properties:

- `executeBatch` (batch size for Oracle JDBC update batching)

  Setting this property enables Oracle JDBC update batching.

- `preFetch` (number of statements to prefetch in Oracle JDBC row prefetching)

  Setting this property enables Oracle JDBC row prefetching.

- `queryTimeout` (number of seconds for the driver to wait for a statement to execute before issuing a timeout)

- `resultSetType` (scrollability of the result set), as indicated by one of the following `int` constants:
  - `TYPE_FORWARD_ONLY` (default)—Use this for a result set that can scroll only forward (using the `next()` method) and cannot be positioned.
  - `TYPE_SCROLL_INSENSITIVE`—Use this for a result set that can scroll forward or backward and can be positioned, but is not sensitive to underlying data changes.
  - `TYPE_SCROLL_SENSITIVE`—Use this for a result set that can scroll forward or backward, can be positioned, and is sensitive to underlying data changes.
- `resultSetConcurrency` (updatability of the result set), as indicated by one of the following `int` constants:
  - `CONCUR_READ_ONLY` (default)—Use this for a result set that is read-only (cannot be updated).
  - `CONCUR_UPDATABLE`—Use this for a result set that is updatable.

You can set these properties with the following methods to enable Oracle JDBC features, as desired:

- `void setExecuteBatch(int)`
- `int getExecuteBatch()`
- `void setPreFetch(int)`
- `int getPreFetch()`
- `void setQueryTimeout(int)`
- `int getQueryTimeout()`
- `void setResultSetConcurrency(int)`

  Specify `CursorBean.CONCUR_READ_ONLY` or `CursorBean.CONCUR_UPDATABLE`.
- `int getResultSetConcurrency()`

  Returns `CursorBean.CONCUR_READ_ONLY` or `CursorBean.CONCUR_UPDATABLE`.

- `void setResultSetType(int)`

  Specify `CursorBean.TYPE_FORWARD_ONLY`, `CursorBean.TYPE_SCROLL_INSENSITIVE`, or `CursorBean.TYPE_SCROLL_SENSITIVE`.

- `int getResultSetType()`

  Returns `CursorBean.TYPE_FORWARD_ONLY`, `CursorBean.TYPE_SCROLL_INSENSITIVE`, or `CursorBean.TYPE_SCROLL_SENSITIVE`.

Note: As with any JavaBean you use in a JSP page, you can set any of the `CursorBean` properties with a `jsp:setProperty` action instead of using the setter method directly.

To execute a query once a `CursorBean` instance has been defined in a `jsp:useBean` statement, you can use `CursorBean` methods to create a cursor in one of two ways. Use the following methods to create the cursor and supply a connection in separate steps:

- `void create()`
- `void setConnBean(ConnBean)`

Alternatively, use the following method to combine the process into a single step:

- `void create(ConnBean)`

Set up the `ConnBean` object as described in "ConnBean for a Database Connection" on page 4-4.

Then use the following method to specify and execute a query. This uses a JDBC plain `Statement` object behind the scenes.

- `ResultSet executeQuery(String)`

  Input a string that contains the `SELECT` statement.

Alternatively, if you want to format the result set as an HTML table or XML string, use either of the following methods instead of `executeQuery()`:

- `String getResultAsHTMLTable(String)`

  Returns a string with HTML statements to create an HTML table for the result set. Specify a string with the `SELECT` statement.

- `String getResultAsXMLString(String)`

  Returns the result set data in an XML string. Specify a string with the `SELECT` statement.

To execute an `UPDATE`, `INSERT`, or `DELETE` statement once a `CursorBean` instance has been defined in a `jsp:useBean` action, you can use `CursorBean` methods to create a cursor in one of two ways. Use the following methods to create the cursor (specifying a statement type as an integer, and SQL statement as a string) and supply a connection:

- `void create(int, String)`
- `void setConnBean(ConnBean)`

Alternatively, use the following method to combine the process into a single step:

- `void create(ConnBean, int, String)`

Set up the `ConnBean` object as described in "ConnBean for a Database Connection" on page 4-4.

The `int` input takes one of the following constants to specify the type of JDBC statement you want: `CursorBean.PLAIN_STMT` for a `Statement` object, `CursorBean.PREP_STMT` for a `PreparedStatement` object, or `CursorBean.CALL_STMT` for a `CallableStatement` object. The `String` input is to specify the SQL statement.

Then use the following method to execute the `INSERT`, `UPDATE`, or `DELETE` statement. (You can ignore the `boolean` return value.)

- `boolean execute()`

Alternatively, for update batching, use the following method, which returns the number of rows affected.

- `int executeUpdate()`

Note: Specify the SQL operation either during statement creation or during statement execution, but not both. The `execute()` and `executeUpdate()` methods can optionally take a string to specify a SQL operation. This is also true of the `create()` method, as well as the `getCursorBean()` method in `ConnBean`.

Additionally, `CursorBean` supports Oracle JDBC functionality such as `registerOutParameter()` for callable statements, `set`*`XXX`*`()` methods for prepared statements and callable statements, and `get`*`XXX`*`()` methods for result sets and callable statements.

Use the following method to close the database cursor:

- `void close()`

Example: Using ConnBean and CursorBean with a Data Source

This following is a sample JSP page that uses `ConnBean` with a data source to open a connection, then uses `CursorBean` to execute a query.

```
<%@ page import="java.sql.*, oracle.jsp.dbutil.*" %>
<jsp:useBean id="cbean" class="oracle.jsp.dbutil.ConnBean" scope="session">
   <jsp:setProperty name="cbean" property="dataSource"
                    value="<%=request.getParameter("datasource")%>"/>
</jsp:useBean>
<% try {
      cbean.connect();
      String sql="SELECT ename, sal FROM scott.emp ORDER BY ename";
      CursorBean cb = cbean.getCursorBean (CursorBean.PREP_STMT, sql);
      out.println(cb.getResultAsHTMLTable());
      cb.close();
      cbean.close();
    } catch (SQLException e) {
      out.println("<P>" + "There was an error doing the query:");
      out.println("<PRE>" + e + "</PRE>\n<P>"); }
%>
```

SQL Tags for Data Access

OC4J includes a set of tags you can use in JSP pages to execute SQL commands to access a database. This section, organized as follows, describes the tags:

- Introduction to Data-Access Tags
- Data-Access Tag Descriptions

Note: The tags in this section use the beans described in "JavaBeans for Data Access" on page 4-2. Generally speaking, these beans and tags can be used with non-Oracle databases, assuming you have appropriate JDBC driver classes; however, numerous features described below, as noted, are Oracle-specific.

Note: The custom SQL tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

Introduction to Data-Access Tags

OC4J supplies a custom tag library for SQL functionality, consisting of the following tags:

- `dbOpen`—Open a database connection. This tag also supports data sources and connection pooling. See "Data-Access Support for Data Sources and Pooled Connections" on page 4-3 for related information.
- `dbClose`—Close a database connection.
- `dbQuery`—Execute a query.
- `dbCloseQuery`—Close the cursor for a query.

- `dbNextRow`—Process the rows of a result set.
- `dbExecute`—Execute any SQL statement (DML or DDL).
- `dbSetParam`—Set a parameter to bind into a `dbQuery` or `dbExecute` tag.
- `dbSetCookie`—Set a cookie.

These tags are described in the following subsections. For examples, see the OC4J demos.

Note the following requirements for using SQL tags:

- You will need the appropriate JDBC driver file, such as `classes12.zip` for JDK 1.2 or higher, installed and in your classpath.
- Verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with the OC4J installation.
- To use the SQL tag library, the tag library descriptor file, `sqltaglib.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory.

For general information about JSP tag library usage, including tag library descriptor files, `taglib` directives, and the well-known tag library directory, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

Note: For applications using the data-access tags, consider using the `dbSetParam` tag to supply only parameter values rather than textual completion of the SQL statement itself. This avoids the possibility of what is referred to as "SQL poisoning", where users might enter additional SQL in addition to the expected value.

Data-Access Tag Descriptions

This section provides detailed syntax for the data-access tags and an example using `dbOpen` and `dbQuery` tags with a data source.

- SQL dbNextRow Tag
- SQL dbExecute Tag
- SQL dbSetParam Tag
- SQL dbSetCookie Tag
- Example: Using dbOpen and dbQuery with a Data Source

For a complete set of sample pages using these tags, see the OC4J demos.

Notes:

- The prefix "sql:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

SQL dbOpen Tag

Use the `dbOpen` tag to open a database connection for subsequent SQL operations through such tags as `dbQuery` and `dbExecute`. Do this by specifying a data source location, in which case connection caches are supported, or by specifying the user, password, and URL individually. See "Data-Access Support for Data Sources and Pooled Connections" on page 4-3 for information about how to set up a data source in OC4J.

The implementation uses `oracle.jsp.dbutil.ConnBean` instances. For simple connections, but not connection caches, you can optionally set `ConnBean` properties such as `stmtCacheSize`, `preFetch`, and `batchSize` to enable those Oracle JDBC features. See "ConnBean for a Database Connection" on page 4-4 for more information.

The `ConnBean` object for the connection is created in an instance of the tag-extra-info class of the `dbOpen` tag. Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about the standard JSP tag library framework and tag-extra-info classes.

Syntax

```
<sql:dbOpen
   [ connId = "connection_id" ]
   [ scope = "page" | "request" | "scope" | "application" ]
   [ dataSource = "JNDI_name" ]
   [ user = "username"
     password = "password"
     URL = "databaseURL" ]
   [ commitOnClose = "true" | "false" ] >

   ...

</sql:dbOpen>
```

Nested code that you want to execute through this connection can go into the tag body, between the `dbOpen` start-tag and end-tag.

Note: You must either set the `dataSource` attribute or set the `user`, `password`, and `URL` attributes. Optionally, you can use a data source to specify a URL, then use the `dbOpen` tag `user` and `password` attributes separately.

When a data source is used, and is for a cache of connections, the first use of the cache initializes it. If you specify the user and password through the `dbOpen` tag `user` and `password` attributes, that will initialize the cache for that user and password. Subsequent uses of the cache are for the same user and password.

Attributes

- `connId`—Optionally use this to specify an ID name for the connection. You can then reference this ID in subsequent tags such as `dbQuery` or `dbExecute`. Alternatively, you can nest `dbQuery` and `dbExecute` tags inside the `dbOpen` tag. You can also reference the connection ID in a `dbClose` tag when you want to close the connection.

  You can still specify a connection ID if you nest `dbQuery` or `dbExecute` tags inside the `dbOpen` tag. In this case, the connection will be found through the connection ID. With the `scope` attribute, it is possible to have multiple connections using the same connection ID but different scopes.

If you specify a connection ID, then the connection is not closed until you close it explicitly with a `dbClose` tag. Without a connection ID, the connection is closed automatically when the `dbOpen` end-tag is encountered.

- `scope` (used only with a `connId`)—Use this to specify the desired scope of the connection instance. The default is `page` scope.

  If you specify a scope setting in a `dbOpen` tag, then you must specify the same scope setting in any other tag—`dbQuery`, `dbExecute`, or `dbClose`—that uses the same connection ID.

- `dataSource` (required if you do not set the `user`, `password`, and `URL` attributes)—Optionally use this to specify the JNDI name of a data source for database connections. First set up the data source in the OC4J `data-sources.xml` file—see "Data-Access Support for Data Sources and Pooled Connections" on page 4-3. The `dataSource` setting should correspond to the `location` name, `ejb-location` name, or `pooled-location` name in a `<data-source>` element in `data-sources.xml`.

  A data source must specify a URL setting, but does not have to specify a user / password pair—you can use the `dbOpen` tag `user` and `password` attributes instead.

  This attribute is supported only in OC4J environments.

- `user` (required if no user / password pair is specified through a data source)—This is the user name for a database connection.

  If a user name is specified through both a data source and the `user` attribute, the `user` attribute takes precedence. It is advisable to avoid such duplication, because conflicts could arise if the data source is a pooled connection with existing logical connections using a different user name.

- `password` (required if no user / password pair is specified through a data source)—This is the user password for a database connection.

  Note that you do *not* have to hardcode a password into the JSP page, which would be an obvious security concern. Instead, you can get the password and other parameters from the `request` object, as follows:

  ```
  <sql:dbOpen connId="conn1" user='<%=request.getParameter("user")%>'
              password='<%=request.getParameter("password")%>' URL="url" />
  ```

  As with the `user` attribute, if a password is specified through both a data source and the `password` attribute, the `password` attribute takes precedence.

- URL (required if no data source is specified)—This is the URL for a database connection. If a URL is supplied through a data source, the dbOpen tag URL attribute is ignored.
- commitOnClose—Set this to "true" for an automatic SQL commit when the connection is closed or goes out of scope. The default "false" setting results in an automatic SQL rollback.

  As a convenience, if you want to specify application-wide automatic commit or rollback behavior, set the parameter name commit-on-close in the application web.xml file, as in the following example:

```
<context-param>
   <param-name>commit-on-close</param-name>
   <param-value>true</param-value>
</context-param>
```

  The commitOnClose setting in a dbOpen tag takes precedence over the commit-on-close setting in web.xml.

> **Note:** In previous releases, the behavior is always to commit automatically when the connection is closed. The commitOnClose attribute offers backward compatibility to simplify migration.

SQL dbClose Tag

Use the dbClose tag to close a connection associated with the optional connId parameter specified in a dbOpen tag. If connId is not used in the dbOpen tag, then the connection is closed automatically when the dbOpen end-tag is reached; a dbClose tag is not required.

Note that by using the JspScopeListener utility provided with OC4J, you can have the connection closed automatically with session-based event-handling. Refer to "JSP Event-Handling with JspScopeListener" on page 8-2 for information.

Syntax

```
<sql:dbClose connId = "connection_id"
          [ scope = "page" | "request" | "scope" | "application" ] />
```

Attributes

- `connId` (required)—This is the ID for the connection being closed, specified in the `dbOpen` tag that opened the connection.
- `scope`—This is the scope of the connection instance. The default is "`page`", but if the `dbOpen` tag specified a scope other than `page`, you must specify that same scope in the `dbClose` tag.

SQL dbQuery Tag

Use the `dbQuery` tag to execute a query, outputting the results either as a JDBC result set, HTML table, XML string, or XML DOM object. Place the `SELECT` statement (one only) in the tag body, between the `dbQuery` start-tag and end-tag.

This tag uses an `oracle.jsp.dbutil.CursorBean` object for the cursor, so you can set properties such as the result set type, result set concurrency, batch size, and prefetch size, if desired. See "CursorBean for DML and Stored Procedures" on page 4-11 for information about `CursorBean` functionality.

For XML usage, this tag acts as an XML producer. See "XML Producers and XML Consumers" on page 5-2 for more information. Also see "Example Using the transform and dbQuery Tags" on page 5-11.

Syntax

```
<sql:dbQuery
          [ queryId = "query_id" ]
          [ connId = "connection_id" ]
          [ scope = "page" | "request" | "scope" | "application" ]
          [ output = "HTML" | "XML" | "JDBC" ]
          [ maxRows = "number" ]
          [ skipRows = "number" ]
          [ bindParams = "value" ]
          [ toXMLObjName = "objectname" ] >

    ...SELECT statement (one only)...

 </sql:dbQuery>
```

Important:

- As of Oracle9*i*AS release 2, do *not* terminate the `SELECT` statement with a semicolon. This will result in a syntax error.
- As of Oracle9*i*AS release 2, the `dbQuery` tag does not currently support LOB columns.

Attributes

- `queryId`—You can use this to specify an ID name for the cursor. This is required if you want to process the results using a `dbNextRow` tag.

  If the `queryId` parameter is present, then the cursor is not closed until you close it explicitly with a `dbCloseQuery` tag. Without a query ID, the cursor is closed automatically when the `dbQuery` end-tag is encountered. This is *not* a request-time attribute, meaning it cannot take a JSP expression value.

- `connId`—This is the ID for a database connection, according to the `connId` setting in the `dbOpen` tag that opened the connection. If you do not specify `connId` in a `dbQuery` tag, then the tag must be nested within the body of a `dbOpen` tag and will use the connection opened in the `dbOpen` tag. This is *not* a request-time attribute.
- `scope`—This is the scope of the connection instance. The default is "`page`", but if the associated `dbOpen` tag specified a scope other than `page`, you must specify that same scope in the `dbQuery` tag. This is *not* a request-time attribute.
- `output`—This is the desired output format, one of the following:
  - `HTML` specifies that the result set be output as an HTML table (default).
  - `XML` specifies that the result set be output as an XML string, or an XML DOM object if an object name is specified in the `toXMLObjName` attribute.
  - `JDBC` specifies that the result set be output as a JDBC `ResultSet` object that can be processed using the `dbNextRow` tag to iterate through the rows.
- `maxRows`—This is the maximum number of rows of data to display.
- `skipRows`—This is the number of data rows to skip in the query results before displaying results.
- `bindParams`—Use this to bind a parameter into the query. The following example is from an application that prompts the user to enter an employee

number, using `bindParams` to bind the specified value into the `empno` field of the query:

```
<sql:dbQuery connId="con1" bindParams="empno">
     select * from EMP where empno=?
</sql:dbQuery>
```

Alternatively, you can set a parameter value with the `dbSetParam` tag to bind it in through the `bindParams` attribute. See "SQL dbSetParam Tag" on page 4-27.

- `toXMLObjName`—Specify an XML object name if you want to output the results as an XML DOM object. (Also set `output` to "`XML`".)

SQL dbCloseQuery Tag

Use the `dbCloseQuery` tag to close a cursor associated with the optional `queryId` parameter specified in a `dbQuery` tag. If `queryId` is not specified in the `dbQuery` tag, then the cursor is closed automatically when the `dbQuery` end-tag is reached; a `dbCloseQuery` tag is not required.

Syntax

```
<sql:dbCloseQuery queryId = "query_id" />
```

Attributes

- `queryId` (required)—The ID for the cursor to be closed, specified in the `dbQuery` tag that opened the cursor.

SQL dbNextRow Tag

Use the `dbNextRow` tag to process each row of a result set obtained in a `dbQuery` tag and associated with the specified `queryId`. Place the processing code in the tag body, between the `dbNextRow` start-tag and end-tag. The body is executed for each row of the result set.

To use the `dbNextRow` tag, the `dbQuery` tag must set `output` to "`JDBC`" and specify a `queryId` for the `dbNextRow` tag to reference.

The result set object is created in an instance of the tag-extra-info class of the `dbQuery` tag. Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about the standard JSP tag library framework and tag-extra-info classes.

Syntax

```
<sql:dbNextRow queryId = "query_id" >
...Row processing...
</sql:dbNextRow >
```

Attributes

- `queryId` (required)—This is the ID of the cursor containing the results to be processed, specified in the `dbQuery` tag that opened the cursor.

Example The following example shows the combined use of a `dbOpen`, `dbQuery`, and `dbNextRow` tag.

```
<sql:dbOpen connId="con1" URL="jdbc:oracle:thin:@myhost:1521:816"
            user="scott" password="tiger">
</sql:dbOpen>
<sql:dbQuery connId="con1" output="jdbc" queryId="myquery">
             select * from EMP
</sql:dbQuery>
<sql:dbNextRow queryId="myquery">
             <%= myquery.getString(1) %>
</sql:dbNextRow>
<sql:dbCloseQuery queryId="myquery" />
<sql:dbClose connId="con1" />
```

SQL dbExecute Tag

Use the `dbExecute` tag to execute a single DML or DDL statement. Place the statement in the tag body, between the `dbExecute` start-tag and end-tag.

This tag uses an `oracle.jsp.dbutil.CursorBean` object for the cursor. See "CursorBean for DML and Stored Procedures" on page 4-11 for information about `CursorBean` functionality.

Syntax

```
<sql:dbExecute
           [ connId = "connection_id" ]
           [ scope = "page" | "request" | "scope" | "application" ]
           [ output = "yes" | "no" ]
           [ bindParams = "value" ] >

   ...DML or DDL statement (one only)...
```

```
</sql:dbExecute >
```

Important:

- As of Oracle9*i*AS release 2, do *not* terminate the DML or DDL statement with a semicolon. This will result in a syntax error.
- As of Oracle9*i*AS release 2, the `dbExecute` tag does not currently support LOB columns.

Attributes

- `connId`—This is the ID of a database connection, according to the `connId` setting in the `dbOpen` tag that opened the connection. If you do not specify `connId` in a `dbExecute` tag, then the tag must be nested within the body of a `dbOpen` tag and will use the connection opened in the `dbOpen` tag.
- `scope`—This is the scope of the connection instance. The default is "`page`", but if the `dbOpen` tag specified a scope other than `page`, you must specify that same scope in the `dbExecute` tag.
- `output`—If `output="yes"`, then for DML statements the HTML string "*number* row[s] affected" will be output to the browser to notify the user how many database rows were affected by the operation. For DDL statements, the statement execution status will be printed. The default is "`no`".
- `bindParams`—Use this to bind a parameter into the SQL statement. The following example is from an application that prompts the user to enter an employee number, using `bindParams` to bind the specified value into the `empno` field of the `DELETE` statement:

  ```
  <sql:dbExecute connId="con1" bindParams="empno">
       delete from EMP where empno=?
  </sql:dbExecute>
  ```

  Alternatively, you can set a parameter value with the `dbSetParam` tag to bind it in through the `bindParams` attribute. See the next section, "SQL dbSetParam Tag".

SQL dbSetParam Tag

You can use this tag to set a parameter value to bind into a query, through the `dbQuery` tag, or to bind into any other SQL operation, through the `dbExecute` tag.

> **Note:** For applications using the data-access tags, consider using the `dbSetParam` tag to supply only parameter values rather than textual completion of the SQL statement itself. This avoids the possibility of what is referred to as "SQL poisoning", where users might enter additional SQL in addition to the expected value.

Syntax

```
<sql:dbSetParam name = "param_name"
                value = "param_value"
              [ scope = "page" | "request" | "scope" | "application" ] />
```

Attributes

- `name` (required)—This is the name of the parameter to set.
- `value` (required)— This is the desired value of the parameter.
- `scope`—This is the scope of the bind parameter. The default is `page` scope.

Example The following example uses a `dbSetParam` tag to set the value of a parameter named `id2`. This value is then bound into the SQL statement in the `dbExecute` tag.

```
<sql:dbSetParam name="id2" value='<%=request.getParameter("id")%>'
                scope="session" />
Result:
   <HR>
   <sql:dbOpen URL="<%= connStr %>" user="scott" password="tiger">
        <sql:dbExecute output="yes" bindParams="id2 name job sal">
             insert into emp(empno, ename, deptno, job, sal)
                    values (?, ?, 20, ?, ?)
        </sql:dbExecute>
    </sql:dbOpen>
    <HR>
```

SQL dbSetCookie Tag

You can use this tag to set a cookie. The `dbSetCookie` tag wraps functionality of the standard `javax.servlet.http.Cookie` class.

Syntax

```
<sql:dbSetCookie name = "cookie_name"
                 [ value = "cookie_value" ]
                 [ domain = "domain_name" ]
                 [ comment = "comment" ]
                 [ maxAge = "age" ]
                 [ version = "protocol_version" ]
                 [ secure = "true" | "false" ]
                 [ path = "path" ] />
```

Attributes

- `name` (required)—This is the name of the cookie.
- `value`—This is the desired value of the cookie. Because it is permissible to have a null-value cookie, this attribute is not required.
- `domain`—This is the domain name for the cookie. The form of the domain name is according to the RFC 2019 specification.
- `comment`—This is for a comment describing the purpose of the cookie.
- `maxAge`—This is the maximum allowable age of the cookie, in seconds. Use a setting of "`-1`" for the cookie to persist until the browser is shut down.
- `version`—This is the version of the HTTP protocol that the cookie complies with.
- `secure`—This informs the browser whether the cookie should be sent using a secure protocol, such as HTTPS or SSL.
- `path`—This specifies a file system path for the cookie, the location to which the client should return the cookie.

Example

```
<sql:dbSetCookie name="cId" value='<%=request.getParameter("id")%>'
                 maxAge='800000' />
```

Example: Using dbOpen and dbQuery with a Data Source

This section provides a sample JSP page that uses a `dbOpen` tag with a data source to open a connection, then uses a `dbQuery` tag to execute a query.

```
<%@ taglib uri="/WEB-INF/sqltaglib.tld" prefix="sql" %>
<HTML>
<BODY>
   <sql:dbOpen dataSource='<%=request.getParameter("datasource") %>'
               connId="con1">
   </sql:dbOpen>
   <sql:dbQuery connId="con1">
      SELECT * FROM emp ORDER BY ename
   </sql:dbQuery>
   <sql:dbClose connId="con1" />
</BODY>
</HTML>
```

5

XML and XSL Tag Support

This chapter describes tags provided with OC4J that you can use for XML data and XSL transformation, and summarizes additional XML functionality in other OC4J tags. These tags are implemented according to JSP specifications.

The chapter is organized as follows:

- Overview of Oracle Tags for XML Support
- XML Utility Tags

Note: See the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for additional information about XML-related functionality for JSP pages.

Overview of Oracle Tags for XML Support

This section provides an overview of tags supplied with OC4J that have XML functionality. This includes tags that can take XML DOM objects as input, generate XML DOM objects as output, transform XML documents according to a specified stylesheet, and parse data from an input stream to an XML DOM object. The following topics are covered:

- XML Producers and XML Consumers
- Summary of OC4J Tags with XML Functionality

Note: The custom XML tag library provided with OC4J pre-dates the JavaServer Pages Standard Tag Library (JSTL) and has areas of duplicate functionality. Going forward, for standards compliance, it is advisable to use JSTL instead of the custom libraries as a general rule. See "Support for the JavaServer Pages Standard Tag Library" on page 1-25.

Oracle is not desupporting the existing tags, however. For features in the custom library that are not yet available in JSTL, where there seems to be general usefulness, Oracle will try in the future to have the features adopted into the JSTL standard as appropriate.

XML Producers and XML Consumers

An XML-related operation can be classified as either of the following, or as both:

- an *XML producer*, which outputs an XML object
- an *XML consumer*, which takes an XML object as input

Similarly, an XML-related tag can be classified as an XML producer, or consumer, or both. XML producers can pass XML objects to XML consumers either explicitly or implicitly; the latter is also known as *anonymous passing*.

For explicit passing between XML-related tags, there is a `toXMLObjName` attribute in the producer tag and a `fromXMLObjName` attribute in the consumer tag. Behind the scenes, the passing is done through the `getAttribute()` and `setAttribute()` methods of the standard JSP `pageContext` object. The following example uses explicit passing.

```
<sql:dbQuery output="XML" toXMLObjName="foo" ... >
   ...SQL query...
</sql:dbQuery>
...
<ojsp:cacheXMLObj fromXMLObjName="foo" ... />
```

For implicit passing between XML-related tags, do not use the `toXMLObjName` and `fromXMLObjName` attributes. The passing is accomplished through direct interaction between the tag handlers, typically in a situation with a nested tag. The following example uses implicit passing:

```
<ojsp:cacheXMLObj ... >
   <sql:dbQuery output="XML" >
      ...SQL query...
   </sql:dbQuery>
</ojsp:cacheXMLObj>
```

Here the XML produced in the `dbQuery` tag is passed to the `cacheXMLObj` tag directly, without being stored to the `pageContext` object.

For a tag to be able to function as a consumer with implicit passing, the tag handler implements the OC4J `ImplicitXMLObjConsumer` interface:

```
interface ImplicitXMLObjConsumer
{
   void setImplicitFromXMLObj();
}
```

Summary of OC4J Tags with XML Functionality

For the tag libraries supplied with OC4J, Table 5–1 summarizes the tags that can function as XML producers or consumers.

Table 5–1 OC4J Tags with XML Functionality

Tag	Library	Producer / Consumer	Related Attributes	Tag Information
transform / styleSheet	XML	both	fromXMLObjName toXMLObjName	"XML transform and styleSheet Tags for XML / XSL Data Transformation" on page 5-6
parsexml	XML	producer	toXMLObjName	"XML parsexml Tag to Convert from Input Stream" on page 5-8

Table 5–1 OC4J Tags with XML Functionality

Tag	Library	Producer / Consumer	Related Attributes	Tag Information
cacheXMLObj	Web Object Cache (and XML)	both	fromXMLObjName toXMLObjName	"Web Object Cache cacheXMLObj Tag" on page 7-27
dbQuery	SQL	producer	toXMLObjName	"SQL dbQuery Tag" on page 4-22

Notes:

- The XML `transform` and `styleSheet` tags are equivalent and produce identical results.
- For convenience, the `cacheXMLObj` tag is defined in the XML tag library descriptor file (`xml.tld`) as well as the Web Object Cache tag library descriptor file (`jwcache.tld`).

XML Utility Tags

This section describes XML utility tags supplied with OC4J, and is organized as follows:

- XML Utility Tag Descriptions
- XML Utility Tag Examples

To use the XML utility tag library, the tag library descriptor file, `xml.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

The XML tag library requires the `ojsputil.jar`, `xmlparserv2.jar`, and `xsu12.jar` (or `xsu111.jar` for JDK 1.1.x) files to be installed and in your classpath. These files are supplied with OC4J.

Notes:

- The prefix "xml:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

XML Utility Tag Descriptions

This section describes the following utility tags:

- XML transform and styleSheet Tags for XML/XSL Data Transformation
- XML parsexml Tag to Convert from Input Stream

Important: Tag attributes are request-time attributes, meaning they can take JSP expressions as input, unless otherwise noted.

XML transform and styleSheet Tags for XML/XSL Data Transformation

Many uses of XML and XSL for dynamic JSP pages require an XSL transformation to occur in the server before results are returned to the client. Oracle provides two synonymous tags in the XML library to simplify this process. You can output the result directly to the HTTP client or, alternatively, you can output to a specified XML DOM object. Use either the `transform` tag or the `styleSheet` tag, as described and shown in this section. The two tags have identical effects.

Each tag acts as both an XML producer and an XML consumer. They can take as input either of the following:

- an XML DOM object
- the tag body, containing JSP commands and static text that produce the XML code

The tags can output to either or both of the following, with the specified stylesheet being applied in either case:

- an XML DOM object
- the output writer to the browser, in which case the specified stylesheet is applied

Each tag applies to what is inside its body, between its start-tag and end-tag. You can have multiple XSL transformation blocks within a page, with each block bounded by its own `transform` or `styleSheet` tag, specifying its own `href` pointer to the appropriate stylesheet.

Syntax

```
<xml:transform href="xslRef"
             [ fromXMLObjName = "objectname" ]
             [ toXMLObjName = "objectname" ]
             [ toWriter = "true" | "false" ] >

   [...body...]

</xml:transform >
```

or:

```
<xml:styleSheet href="xslRef"
             [ fromXMLObjName = "objectname" ]
             [ toXMLObjName = "objectname" ]
             [ toWriter = "true" | "false" ] >
```

```
   [...body...]

</xml:styleSheet >
```

Attributes

- `href` (required)—Specify the XSL stylesheet to use for the XML data transformation. This is required whether you are outputting to an XML object (where you can have transformation without formatting) or to the browser.

  Note the following regarding the `href` attribute:

  - It can refer to either a static XSL stylesheet or a dynamically generated one. For example, it can refer to a JSP page or servlet that generates the stylesheet.
  - It can be a fully qualified URL (`http://host[:port]/path`), an application-relative JSP reference (starting with "`/`"), or a page-relative JSP reference (not starting with "`/`"). Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about application-relative and page-relative paths.
  - Its value can be a static Java string constant literal, or it can be dynamically specified through a standard JSP request-time expression.

- `fromXMLObjName`—Use this to specify an input XML DOM object if input is from a DOM object instead of from the tag body. If there is both a tag body and a `fromXMLObjName` specification, `fromXMLObjName` takes precedence.
- `toXMLObjName`—Use this to specify the name of an output XML DOM object if output is to a DOM object, instead of or in addition to going to the JSP writer object for output to the HTTP client. This is not required if there is an implicit XML consumer, such as a tag within which the `transform` or `styleSheet` tag is nested.
- `toWriter`—This is "`true`" or "`false`" to indicate whether output goes to the JSP writer object for output to the HTTP client. This can be instead of or in addition to output to a DOM object. The default is "`true`" for backward compatibility. (Prior to Oracle9*i*AS release 2, this was the only output choice; there was no `toXMLObjName` attribute.)

XML parsexml Tag to Convert from Input Stream

The XML tag library supplies an XML producer utility tag, `parsexml`, that converts from an input stream to an XML DOM object. This tag can take input from a specified resource or from the tag body.

Syntax

```
<xml:parsexml
             [ resource = "xmlresource" ]
             [ toXMLObjName = "objectname" ]
             [ validateResource = "dtd_path" ]
             [ root = "dtd_root_element" ] >

   [...body...]

</xml:parsexml >
```

Attributes

- `resource`—Use this to specify an XML resource if input is from a resource instead of from the tag body. For example:

  ```
  resource="/dir1/hello.xml"
  ```

  If there is both a tag body and a specified resource, the resource takes precedence.

- `toXMLObjName`—Specify the name of the XML DOM object where the output will go. This is not required if there is an implicit XML consumer, such as a tag within which the `parsexml` tag is nested.

- `validateResource`—For XML validation, you can specify the path to the appropriate DTD. Alternatively, the DTD can be embedded in the XML resource. This is *not* a request-time attribute.

- `root`—If validating, specify the root element in the DTD for validation. This is *not* a request-time attribute. If you specify `validateResource` without specifying `root`, the default root is the top-level of the DTD.

XML Utility Tag Examples

This section provides the following examples:

- Example Using the transform Tag
- Example Using the transform and dbQuery Tags
- Examples Using the transform and parsexml Tags

Example Using the transform Tag

This section provides a sample XSL stylesheet and a sample JSP page that uses the `transform` tag to filter its output through the stylesheet. This is a simplistic example—the XML in the page is static. A more realistic example might use the JSP page to dynamically generate all or part of the XML before performing the transformation.

Sample Stylesheet: hello.xsl

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

  <xsl:template match="page">
   <html>
    <head>
     <title>
      <xsl:value-of select="title"/>
     </title>
    </head>
    <body bgcolor="#ffffff">
     <xsl:apply-templates/>
    </body>
   </html>
  </xsl:template>

  <xsl:template match="title">
   <h1 align="center">
    <xsl:apply-templates/>
   </h1>
  </xsl:template>
  <xsl:template match="paragraph">
   <p align="center">
    <i>
     <xsl:apply-templates/>
    </i>
```

```
   </p>
  </xsl:template>

</xsl:stylesheet>
```

Sample JSP Page: hello.jsp

```
<%@ page session = "false" %>
<%@ taglib uri="/WEB-INF/xml.tld" prefix="xml" %>

<xml:transform href="style/hello.xsl" >

<page>
 <title>Hello</title>
 <content>
  <paragraph>This is my first XML/XSL file!</paragraph>
 </content>
</page>

</xml:transform>
```

This example results in the following output:

Example Using the transform and dbQuery Tags

This example returns a result set from a `dbQuery` tag, using a `transform` tag to filter the query results through the XSL stylesheet `rowset.xsl` (code below). It uses a `dbOpen` tag to open a connection, with the connection string being obtained either from the `request` object or through the `setconn.jsp` page (code below). Data passing from the `dbOpen` tag to the `transform` tag is done implicitly. For related information, see "SQL dbQuery Tag" on page 4-22 and "SQL dbOpen Tag" on page 4-18.

JSP Page

```
<%@ page import="oracle.sql.*, oracle.jdbc.driver.*, oracle.jdbc.*, java.sql.*"
%>
<%@ taglib uri="/WEB-INF/xml.tld" prefix="xml" %>
<%@ taglib uri="/WEB-INF/sqltaglib.tld" prefix="sql" %>

<%
   String connStr=request.getParameter("connStr");
   if (connStr==null) {
     connStr=(String)session.getValue("connStr");
   } else {
     session.putValue("connStr",connStr);
   }
   if (connStr==null) { %>
<jsp:forward page="../../sql/setconn.jsp" />
<%
   }

%>
<h3>Transform DBQuery Tag Example</h3>
<xml:transform href="style/rowset.xsl" >
<sql:dbOpen connId="conn1" URL="<%= connStr %>"
              user="scott" password="tiger">
    </sql:dbOpen>
    <sql:dbQuery connId="conn1" output="xml" queryId="myquery" >
       select ENAME, EMPNO from EMP order by ename
    </sql:dbQuery>
    <sql:dbCloseQuery queryId="myquery" />
    <sql:dbClose connId="conn1" />
</xml:transform>
```

rowset.xsl

```
<xsl:stylesheet version='1.0' xmlns:xsl='http://www.w3.org/1999/XSL/Transform'>
<xsl:template match="ROWSET">
 <html><body>
 <h1>A Simple XML/XSL Transformation</h1>
 <table border="2">
<xsl:for-each select="ROW">
  <tr>
    <td><xsl:value-of select="@num"/></td>
    <td><xsl:value-of select="ENAME"/></td>
    <td><xsl:value-of select="EMPNO"/></td>
  </tr>
</xsl:for-each>
</table>
</body></html>
</xsl:template>
</xsl:stylesheet>
```

setconn.jsp

```
<body bgcolor="#FFFFFF">
<font size=+0>
<B>Please enter a suitable JDBC connection string, before you try the above
demo</B>
<pre>
     To use the thin driver insert your host, port and database id.
     Once you have set the connection string it will remain in effect until
     the session times out for most demos.  For Connection Cache demos
     which use application scope on most servlet engines the connection
     string will remain in effect for the life of the application.
</pre>
<%
   String connStr;
   connStr=request.getParameter("connStr");
   if (connStr==null) {
     connStr=(String)session.getValue("connStr");
   }
   if (connStr==null) {
     connStr="jdbc:oracle:thin:@localhost:1521:orcl";  // default connection str
   }

   session.putValue("connStr",connStr);
%>
<FORM METHOD=get>
```

```
<INPUT TYPE="text" NAME="connStr" SIZE=40 value="<%=connStr%>" >
<INPUT TYPE="submit" VALUE="Set Connection String" >
</FORM>
</font>
```

Examples Using the transform and parsexml Tags

This section provides two examples that take output from a `parsexml` tag and filter it through a `transform` tag, using the XSL stylesheet `email.xsl`. In each case, data is collected by the `parsexml` tag handler from a specified resource XML file, then passed explicitly from the `parsexml` tag to the `transform` tag through the `toxml1` XML object.

The first example uses the XML resource `email.xml` and a separate DTD, `email.dtd`. No `root` attribute is specified, so validation is from the top-level element, `<email>`.

The second example uses the XML resource `emailWithDtd.xml`, which has the DTD embedded in the file. The `root` attribute explicitly specifies that validation is from the element `<email>`.

The files `email.xml`, `email.dtd`, `emailWithDtd.xml`, and `email.xsl` are also listed below.

Example 1 for transform and parsexml

```
<%@ taglib uri="/WEB-INF/xml.tld" prefix="xml" %>
<h3>XML Parsing Tag Email Example</h3>
<xml:transform fromXMLObjName="toxml1" href="style/email.xsl">
   <xml:parsexml resource="style/email.xml" validateResource="style/email.dtd"
                toXMLObjName="toxml1">
   </xml:parsexml>
</xml:transform>
```

Example 2 for transform and parsexml

```
<%@ taglib uri="/WEB-INF/xml.tld" prefix="xml" %>
<h3>XML Parsing Tag Email Example</h3>
<xml:transform fromXMLObjName="toxml1" href="style/email.xsl">
   <xml:parsexml resource="style/emailWithDtd.xml" root="email"
                 toXMLObjName="toxml1">
   </xml:parsexml>
</xml:transform>
```

email.xml

```
<email>
<recipient>Manager</recipient>
<copyto>jsp_dev</copyto>
<subject>XML Bug fixed</subject>
<bugno>BUG 1109876!</bugno>
<body>for reuse tag and checked in the latest version!</body>
<sender>Developer</sender>
</email>
```

email.dtd

```
<!ELEMENT email (recipient,copyto,subject,bugno,body,sender)>
<!ELEMENT recipient (#PCDATA)>
<!ELEMENT copyto (#PCDATA)>
<!ELEMENT subject (#PCDATA)>
<!ELEMENT bugno (#PCDATA)>
<!ELEMENT body (#PCDATA)>
<!ELEMENT sender (#PCDATA)>
```

emailWithDtd.xml

```
<!DOCTYPE email [
<!ELEMENT email (recipient,copyto,subject,bugno,body,sender)>
<!ELEMENT recipient (#PCDATA)>
<!ELEMENT copyto (#PCDATA)>
<!ELEMENT subject (#PCDATA)>
<!ELEMENT bugno (#PCDATA)>
<!ELEMENT body (#PCDATA)>
<!ELEMENT sender (#PCDATA)>]>
<email>
<recipient>Manager</recipient>
<copyto>jsp_dev</copyto>
<subject>XML Bug fixed</subject>
<bugno>BUG 1109876!</bugno>
<body>for reuse tag and checked in the latest version!</body>
<sender>Developer</sender>
</email>
```

email.xsl

```
<xsl:stylesheet version='1.0' xmlns:xsl='http://www.w3.org/1999/XSL/Transform'>
<xsl:template match="email">
 <html><body>
  To: <xsl:value-of select="recipient"/>
  CC: <xsl:value-of select="copyto"/>
  Subject:   <xsl:value-of select="subject"/> ...
  <xsl:value-of select="body"/> !!
  Thanks  <xsl:value-of select="sender"/>
</body></html>
</xsl:template>
</xsl:stylesheet>
```

6

JESI Tags for Edge Side Includes

This chapter describes the JESI (JSP to ESI) tag library that is supplied with OC4J. These tags operate on top of an Edge Side Includes (ESI) framework available in the Oracle9*i*AS Web Cache to provide ESI caching functionality in a JSP application.

The chapter includes the following topics:

- Overview of Edge Side Includes Technology and Processing
- Overview of JESI Functionality
- Oracle JESI Tag Descriptions
- JESI Tag Handling and JESI-to-ESI Conversion

For an overview of Web caching, including discussion of the Oracle9*i*AS Web Cache, the Oracle9*i* Application Server Java Object Cache, and the OC4J Web Object Cache, see "Summary of Oracle Caching Support for Web Applications" on page 1-18.

Overview of Edge Side Includes Technology and Processing

This section provides background information about some of the underlying technology upon which the Oracle JESI tags are based.

JESI tags, which are used to break down dynamic content of JSP pages into cacheable components, are based upon the Edge Side Includes architecture and ESI markup language.

Although the use of JESI tags is not dependent upon any particular ESI processor or caching system, it is reasonable to assume that most Oracle customers would use the Oracle9*i*AS Web Cache and its ESI processor.

This section covers the following topics:

This discussion provides only a brief overview of the ESI architecture and language. For additional information about ESI technology, refer to the following Web site:

`http://www.edge-delivery.org`

Edge Side Includes Technology

This section introduces the features of ESI technology and the concept of ESI *surrogates*.

Introduction to ESI

Edge Side Includes is an XML-style markup language that allows dynamic content assembly away from the origin Web server—at the "edge" of the network—and is designed to take advantage of available tools such as Web caches and content delivery networks (CDNs) to improve performance for end users.

ESI provides a means of reducing the load on Web and application servers by promoting processing on intermediaries, known as *surrogates* or *reverse proxies*, that understand the ESI language and act on behalf of the Web server. ESI content is intended for processing somewhere between the time it leaves the originating Web server and the time it is displayed in the end user's browser. A surrogate is commanded through HTTP headers. Such a surrogate can be referred to as an *ESI processor* and can be included as part of the functionality of a Web cache.

ESI lends itself to a partial-page caching methodology, where each dynamic portion of a Web page can be cached individually and retrieved separately and appropriately.

Using the ESI markup tags, a developer can define aggregate Web pages and the cacheable components that are to be retrieved and assembled, as appropriate, by the ESI processor for viewing in the HTTP client. You can think of an aggregate page, which is the resource associated with the URL that an end user specifies, as simply a container for assembly, including retrieval and assembly instructions that are specified through the ESI tags.

Note: Bear in mind that a JESI user does not have to (and would typically not want to) use ESI tags directly. JESI tag handlers translate JESI tags to ESI tags behind the scenes.

More About Surrogates

Because surrogates act on behalf of Web servers, where page content is owned, they allow content owners to have sufficient control over their behavior. In this way, they offer greater potential for performance improvements than would otherwise be available.

The caching process in surrogates operates similarly to the caching process in HTTP in general, using similar freshness and validation mechanisms as the foundation. However, surrogates also possess additional control mechanisms.

Key ESI Features

Version 1.0 of the ESI language includes the following key areas of functionality:

- inclusion

  An ESI processor assembles fragments of dynamic content, retrieved from the network, into aggregate pages to output to the user. Each fragment can have its own meta data to control its caching behavior.

- support of variables

  ESI supports the use of variables based on HTTP request attributes. ESI statements can use variables during processing or can output them directly into the processed markup.

- conditional processing

  ESI allows use of boolean comparisons for conditional logic in determining how pages are processed.

- error handling and alternative processing

  Some ESI tags support specification of a default resource or an alternative resource (or both), such as an alternate Web page, if the primary resource cannot be found.

Oracle9*i*AS Web Cache and ESI Processor

This section introduces the Oracle9*i*AS Web Cache and its ESI processor. See the *Oracle9iAS Web Cache Administration and Deployment Guide* for more information.

Introduction to Oracle9*i*AS Web Cache

Oracle offers Oracle9*i*AS Web Cache to help e-businesses manage Web site performance issues. It is a content-aware server accelerator, or *reverse proxy server*, that improves the performance, scalability, and availability of Web sites that run on the Oracle9*i* Application Server.

By storing pages from frequently accessed URLs in memory, Oracle9*i*AS Web Cache eliminates the need to repeatedly process requests for those URLs on the application Web server. Unlike legacy proxy servers that handle only static documents, Oracle9*i*AS Web Cache caches both static content and dynamically generated content from one or more application Web servers. As the result of more frequent cache hits, there is greater performance enhancement than with legacy proxies, and much less load on application servers.

Conceptually, Oracle9*i*AS Web Cache is positioned in front of application Web servers, caching their content and sending that content to Web browsers that request it. When Web browsers access the Web site, they send HTTP protocol or HTTPS protocol requests to Oracle9*i*AS Web Cache, which, in turn, acts as a virtual server for the application Web servers. If the requested content has expired, or has been invalidated, or is no longer accessible, then Oracle9*i*AS Web Cache retrieves the new content from the application Web servers.

Steps in Oracle9*i*AS Web Cache Usage

Here are the steps for typical browser interaction with Oracle9*i*AS Web Cache:

1. A browser sends a request to the Web site of a company.

   This request, in turn, generates a request to the Domain Name System (DNS) for the IP address of the Web site.

2. DNS returns the IP address of Oracle9*i*AS Web Cache.
3. The browser sends the request for the Web page to Oracle9*i*AS Web Cache.
4. If the requested content is in its cache, Oracle9*i*AS Web Cache sends the content directly to the browser. This is known as a *cache hit*.
5. If Oracle9*i*AS Web Cache does not have the requested content, or the content is stale or invalid, then the Web cache hands off the request to the application Web server. This is known as a *cache miss*.
6. The application Web server sends the content through Oracle9*i*AS Web Cache.
7. Oracle9*i*AS Web Cache sends the content to the client and makes a copy of the page in cache.

Note: A page that is stored in the cache is removed when it becomes invalid or outdated.

Oracle9*i*AS Web Cache ESI Processor

Oracle9*i*AS Web Cache includes an ESI processor to support the use of the Edge Side Includes markup language in caching. (See "Edge Side Includes Technology" on page 6-2.)

Web developers in an Oracle9*i*AS Web Cache environment can use the ESI language directly in their applications; however, for JSP developers, there are a number of reasons to use the JESI tag library that is provided as a convenient JSP interface to the ESI language. See "Advantages of JESI Tags" on page 6-6.

Overview of JESI Functionality

This section introduces JESI functionality and the Oracle implementation, covering the following topics:

- Advantages of JESI Tags
- Overview of JESI Tags Implemented by Oracle
- JESI Usage Models
- Invalidation of Cached Objects
- Personalization of Cached Pages

You can access the proposed JESI specification at the following Web site:

`http://www.edge-delivery.org`

Advantages of JESI Tags

OC4J provides the JESI tag library as a convenient interface to ESI tags and Edge Side Includes functionality for Web caching. Developers have the option of using ESI tags directly in any Web application, but JESI tags provide additional convenience in a JSP environment. Here are the main advantages in using JESI tags instead of using ESI tags directly:

- standard JSP framework and convenient features

  For developers accustomed to using JSP pages or working in a JSP IDE environment, JESI tags allow use of the familiar and convenient features of JSP programming. For example, you can reference included pages by page-relative or application-relative syntax instead of the complete URL or file path.

- JESI shortcut syntax

  JESI tags support convenient syntax and tag attributes for specifying meta data information (such as expiration for cached pages), explicitly invalidating pages as appropriate, and personalizing pages using cookie information.

- application-level configuration files

  The JESI tag library can use application-level configuration files for convenient specification of deployment-time parameters and application default settings that are appropriate to a particular environment. In this way, you can deploy to different environments that have diverse needs and set appropriate defaults without changing application code. For example, you can use such a

configuration file to preset the cache server URL, user name, and password for invalidation requests.

Overview of JESI Tags Implemented by Oracle

The Oracle implementation of JESI is layered on top of the standard ESI framework. Because the JESI tag library is a standard implementation, note the following:

- You can use it in any standard JSP environment—it does not depend on the OC4J JSP container.
- Even though this document discusses the Oracle9*i*AS Web Cache and its ESI processor in particular, the JESI tag library does not depend on any particular caching environment and can work with any ESI processor that conforms to the ESI 1.0 specification.

The Oracle JESI tag library supports the following tags:

- JESI `control`, JESI `include`, JESI `template`, and JESI `fragment` for page setup and content
- JESI `invalidate` (and subtags) for explicit invalidation of cached objects when appropriate
- JESI `personalize` for page customization

JSP developers use these tags (such as JESI `include`) instead of corresponding ESI tags (such as `esi:include`). The usefulness and convenience of this is discussed previously, in "Advantages of JESI Tags" on page 6-6.

Note: The Oracle JESI tag library is a standard library. For general information about the standard JavaServer Pages tag library framework, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

JESI Usage Models

There are two models for how to use JESI tags to define aggregate pages and their cacheable components:

- the control / include model
- the template / fragment model

This section describes these models, and concludes with some special notes about the JESI `include` tag.

Control/Include Model

One approach to using JESI tags is a modular one, typically bringing most (or all) cacheable content into the aggregate page as included pages. Generally use this model as follows:

- Use the JESI `control` tag in the top-level page to set caching parameters for content outside of the included content, if appropriate.
- Use JESI `include` tags to bring in dynamic content.
- Use a JESI `control` tag inside each included page to set caching parameters for those pages, as appropriate.

This document refers to this modular approach as the *control/include* model. It is particularly convenient in a situation where you are developing new pages.

Each included file is a distinct cacheable object (although caching may be disabled according to tag settings), and any additional content in the aggregate page is also a distinct object.

Both tags are optional, depending on the situation. A page can have a JESI `control` tag without any JESI `include` tags. In fact, this is a simple way to convert an existing page for JESI use. There is also no requirement for a JESI `control` tag in a page that uses JESI `include` tags.

For a page, either top-level or included, that does not specify cacheability through a JESI `control` tag, its cacheability depends on configuration settings of the ESI processor. This applies if the page has no JESI `control` tag, or if it has a JESI `control` tag that does not set the `cache` attribute.

Notes: The JESI `control` tag in the aggregate page has no effect on included pages. An included page without its own JESI `control` tag uses default cache settings.

See the following sections for tag syntax and examples:

- "JESI control Tag" on page 6-14
- "JESI include Tag" on page 6-15
- "Examples: Control/Include Model" on page 6-17

Template/Fragment Model

Another JESI tag approach is one where content is in the aggregate page itself, and you split the page into separately cacheable fragments as desired. Use the JESI `template` tag to enclose the aggregate of all cacheable content. This tag sets caching parameters for the aggregate page outside the fragments. Use JESI `fragment` tags as desired to define fragments within the aggregate, to be cached separately.

This document refers to this scenario as the *template/fragment* model. It is particularly convenient in a situation where you are converting existing pages for JESI use. There can optionally be JESI `include` tags as well, either at the template level or the fragment level.

The JESI `template` tag and JESI `fragment` tag are always used together. If you do not need separate fragments in a page, use JESI `control` instead of JESI `template`.

Each fragment is a distinct cacheable object, and dynamic content at the template level, outside of any fragments, is a distinct cacheable object. Any included page is also a distinct cacheable object. The cacheability of the template code outside the fragments depends on the `cache` attribute setting, if any, of the JESI `template` tag. The cacheability of any fragment depends on the `cache` attribute setting, if any, of the JESI `fragment` tag. The cacheability of an included page depends on the `cache` attribute setting of the JESI `control` tag, if any, within that page. For any template, fragment, or included page that does not specify a `cache` attribute setting, its cacheability depends on configuration settings of the ESI processor.

Because the template and fragments are independent cacheable objects, they may expire at different points in time in the ESI processor. When a cache miss occurs or an object that has expired is requested, the ESI processor will make a request to the origin server (OC4J in the case of Oracle9*i*AS) for a fresh copy. If a requested object is a JESI template, the JSP engine will execute the template code; that is, all code in the page that is outside any fragments. In output generated by the JSP translator, the translator will also place ESI markup that designates where all the fragments should be included. The code contained in the JESI fragments will not be executed at that time.

When a fragment expires, the ESI processor will make a request to the origin server for that particular fragment. In order to execute a fragment, the OC4J JSP container will execute the template code (all code outside of the fragments) plus the code of the fragment being requested. In the resulting page, there will be the output of the template, ESI markers for the inclusion of the other fragments, and the results of the requested fragment. These fragment results will be *inlined* (inserted) into the page at

the appropriate point. Upon receiving the response, the ESI processor will find the inlined fragment in the page and cache the updated copy of that fragment. The Oracle ESI processor will discard the rest of the page. (Behavior may differ in other ESI processors.) The Oracle9*i*AS Web Cache does *not* update the template when it requests a fresh fragment.

Keep this behavior in mind when choosing expiration policies for your templates and fragments. In order to divide a page into template and fragments correctly and efficiently, it is important to remember what portion of a JSP page is executed during any particular update request. For example, because the template code is executed in every update request, try not to place an expensive computation at the template level, unless it must be executed every time. It is usually preferable to place expensive computation in a fragment that has as long an expiration time as possible.

Also be aware that no two fragments are ever executed during the same request. Therefore, you should not declare or set the value of a scriptlet variable in one fragment and depend on that variable or the set value in another fragment. If a variable is needed in more than one fragment, it should be declared and set in the template code. Similarly, but perhaps less obviously, do not set a request or session attribute in one fragment and then try to read it in another fragment. Such "page global logic" should also be placed at the template level.

Important: In Oracle9*i*AS release 2, you cannot use the JESI template / fragment model and explicit ESI markup (such as `<esi:inline>` for example) within the same HTTP response.

For example, Oracle9*i*AS Web Cache errors will occur if there is a JSP page that uses `<jesi:template>` and `<jesi:fragment>` tags and also includes a servlet that generates HTML with `<esi:inline>` tags.

See the following sections for tag syntax and examples:

- "JESI template Tag" on page 6-20
- "JESI fragment Tag" on page 6-21
- "JESI include Tag" on page 6-15
- "Examples: Template / Fragment Model" on page 6-22

Notes About JESI Includes

In using either model, be aware of the following notes regarding the JESI `include` statement:

- Nested inclusions are supported, either as a JESI `include` statement that includes a page that in turn has its own JESI `include` statement, or as a JESI `include` statement inside a fragment defined with JESI `fragment`.

  In the latter case, for example, the ESI processor first requests content of the aggregate page, next requests content of the fragment, and finally requests content of the included page within the fragment.

- Despite conceptual similarities between JESI `include` and `jsp:include`, JESI `include` is *not* a perfect substitute for `jsp:include` when you convert a JSP page for caching. Because the ESI processor uses separate HTTP requests, you are unable to pass an HTTP request or response object between an aggregate page and a page it includes through a JESI `include` tag. If the code in the included page needs access to the request or response object of the aggregate page, you can put the code in a JESI `fragment` tag (within the JESI `template` tag of the aggregate page) instead of in an included page.

Invalidation of Cached Objects

There may be situations where cached objects must be explicitly invalidated due to external circumstances, such as changes to relevant data in a database. There may also be situations where execution of one page may invalidate the data of cached objects corresponding to another page.

For this reason, JESI provides the JESI `invalidate` tag and several subtags. These tags allow you to invalidate pages based on appropriate combinations of the following:

- a full URI or URI prefix
- a cookie name-value pair (optional)
- an HTTP / 1.1 request header name-value pair (optional)

Invalidation messages are in an XML-based format and specify the URLs to be invalidated. These messages are initiated by the JSP container when it executes the JESI `invalidate` tag, and transmitted to the cache server over HTTP using a `POST` method. The cache server then replies with an invalidation response, sent back over HTTP.

See "Tag and Subtag Descriptions for Invalidation of Cached Objects" on page 6-23 for tag syntax and examples.

Personalization of Cached Pages

Dynamic Web pages frequently display customized information tailored to each individual user. For example, a welcome page may display the user's name and a special greeting, or current quotes for stocks the user owns.

For this kind of tailored output, the Web page depends on cookie information, which can be provided through the JESI `personalize` tag. Without this tag to inform the ESI processor of this dependency, the Web page cannot be shared by multiple users at the ESI level.

See "Tag Description for Page Personalization" on page 6-30 for tag syntax and examples.

Note: Do not confuse this tag with the Oracle9*i*AS Personalization tag library, which encompasses much more functionality. JESI personalization consists of the ESI processor simply replacing place holders in a cached page with dynamic strings that come from cookies sent in a request or response. This enables different users to share the same cached page. Oracle Personalization, using data mining on the back-end, is much more dynamic. It produces output that changes automatically according to user activity. See Chapter 9, "Oracle9iAS Personalization Tags" for more information.

Oracle JESI Tag Descriptions

This section describes the syntax and attributes for the JESI tags provided with OC4J, followed by usage examples. Discussion is organized into the following categories:

- Tag Descriptions for Page Setup and Content
- Tag and Subtag Descriptions for Invalidation of Cached Objects
- Tag Description for Page Personalization

The Oracle JESI tag library, a standard JavaServer Pages tag library implementation, is included in the `ojsputil.jar` file, which is provided with OC4J. Verify that this file is installed and in your classpath.

To use the JESI tag library, the tag library descriptor file, `jesitaglib.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "jesi:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.
- Except where noted otherwise, default settings are determined by the ESI processor. In the case of the Oracle9*i*AS Web Cache ESI processor, this is according to the cache configuration file.

Tag Descriptions for Page Setup and Content

This section summarizes the use of the following tags, and documents their syntax and attributes:

- JESI `control`
- JESI `include`
- JESI `template`

- JESI `fragment`

This section also provides examples of both the control/include model and the template/fragment model. See "JESI Usage Models" on page 6-7 for overviews of these models.

JESI control Tag

The JESI `control` tag controls caching characteristics for JSP pages in the control/include usage model. You can use a JESI `control` tag in the top-level page or any included page, but it is not mandatory. For any page without a JESI `control` tag, or with a JESI `control` tag that has no `cache` attribute setting, cacheability is according to the configuration settings of the ESI processor. (See "JESI Usage Models" on page 6-7.)

The JESI `control` tag should appear as early as possible in the page, before any other JESI tags or any buffer flushes in the page.

Be aware of the following:

- Do not use multiple JESI `control` tags in a single JSP page. Also do not use additional JESI `control` tags in pages that are included, through `jsp:include` functionality, into the same response object. In either case, an exception will result.
- Do not use a JESI `control` tag and a JESI `template` tag in the same page, or in separate pages that are included into the same response object. An exception will result.
- The JESI `control` tag of the aggregate page has no effect on included pages. Use a JESI `control` tag in each included page as well, as necessary.
- If a page with a JESI `control` tag depends on request parameters, consider whether you must cache the page with parameters (as opposed to without parameters) in the ESI server. Another alternative is to not cache the page at all (set `cache="no"`), if you anticipate that too many different request parameter values will result in too many cached entries for the page.

Syntax

```
<jesi:control
            [ expiration = "value" ]
            [ maxRemovalDelay = "value" ]
            [ cache = "yes" | "no" | "no-remote" ] />
```

Note: The proposed JESI specification includes a `control` attribute for the JESI `control`, JESI `template`, and JESI `fragment` tags. This attribute is for setting parameters of ESI control headers directly. The Oracle9*i*AS release 2 implementation, however, supports setting only the control header `max-age` parameter. Setting this is unnecessary, though, because setting the `expiration` and `maxRemovalDelay` attributes of the JESI `control` tag serves the same purpose. Therefore, the `control` attribute is not currently documented in this manual.

Attributes

- `expiration`—Specifies the lifetime, in seconds, of the cached object. The default is 300.
- `maxRemovalDelay`—Specifies the maximum time, in seconds, that the ESI processor can store the cached object after it has expired. The default is 0, for immediate removal.
- `cache`—Specifies whether the object corresponding to the tag is cacheable. Set `cache` to "`yes`" to enable caching. Alternatively, you can set `cache` to "`no`" to disable caching, or to "`no-remote`" to enable caching only on the closest cache, instead of on a remote ESI processor or content delivery network. If you do not set the `cache` parameter, then cacheability depends on the configuration settings of the ESI processor.

  One reason to make a page non-cacheable, for example, is if you are using a JESI `include` tag with `copyparam` enabled. See "JESI include Tag" below.

JESI include Tag

The JESI `include` tag, as with a standard `jsp:include` tag, dynamically inserts output from the included page into output from the including page. Additionally, it directs the ESI processor to process and assemble the included pages. Each included page is a separate cacheable object (or non-cacheable, depending on settings).

You can use this tag in either the control/include model or the template/fragment model, in any of the following scenarios:

- by itself, without a JESI `control` tag or JESI `template` and `fragment` tags
- after a JESI `control` tag
- within a JESI `template` tag, outside of any fragments

- within a JESI `fragment` tag

(See "JESI Usage Models" on page 6-7.)

The cacheability of an included page depends on the `cache` attribute setting of the JESI `control` tag (if any) within that page. If there is no `cache` setting, then cacheability depends on configuration settings of the ESI processor.

Although the JESI `include` tag has similarities in usage to `jsp:include`, its different semantics make it unsuitable for page inclusions where request or response objects must be passed between the originating page and the included page.

Syntax

```
<jesi:include page = "uri"
            [ alt = "alternate_uri" ]
            [ ignoreError = "true" | "false" ]
            [ flush = "true" | "false" ]
            [ copyparam = "true" | "false" ] />
```

Attributes

- `page` (required)—Specifies the URI of the JSP page to be included, using either page-relative or application-relative syntax. (Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about page-relative and application-relative syntax.) A full "`http://...`" or "`https://...`" URL is supported as well.
- `alt`—Specifies a URI for an alternate page that is to be included if the page that is specified in the `page` attribute cannot be accessed. Syntax is the same as for the `page` attribute.
- `ignoreError`—Set this to "`true`" for continued processing of the including page even if no included page (neither the `page` page nor `alt` page) can be accessed. The default is "`false`".
- `flush`—This attribute is ignored, but is allowed in order to ease migration from `jsp:include` syntax.
- `copyparam`—If the included page makes use of request parameters, set this to "`true`" to copy parameters and their values from the HTTP request string of the including page to the included page. The default is "`false`".

  If request parameters are significant to the included page and `copyparam="true"`, then either the including page should not be cached

(`cache="no"` in the JESI `control`, JESI `template`, or JESI `fragment` tag), or, in the ESI server, the included page should be cached with parameters (instead of without parameters). As an example, you should generally avoid scenarios such as the following:

```
<jesi:control cache="yes"/>
...
<jesi:include page="arf.jsp" copyparam="true" />
```

The reason is that if you serve a copy of this including page from the cache, the page will not execute on the server or have a chance to properly copy parameters into `arf.jsp`. This would result in clients being served `arf.jsp` generated from incorrect parameters.

However, this scenario would *not* be problematic in certain circumstances, such as either of the following:

– The `arf.jsp` page does not use the request parameters. In this case, though, it is advisable to remove the `copyparam` attribute or set it to "`false`".

or:

– The `arf.jsp` page is cached in the ESI server with URL parameters. See the *Oracle9iAS Web Cache Administration and Deployment Guide* for more information.

Examples: Control/Include Model

This section provides examples of JESI tag usage in the control/include model.

For a complete sample application using JESI tags, refer to the OC4J demos.

Example 1: Control/Include The following example employs default cache settings; no JESI `control` tag is necessary. The JESI `include` tags specify no alternate files, and a "file not found" error will halt processing. The `flush` attribute is permissible but ignored.

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>
<html>
<body>
<jesi:include page="stocks.jsp" flush="true" />
<p>
<hr>
<jesi:include page="/weather.jsp" flush="true" />
<p>
```

```
<hr>
<jesi:include page="../sales.jsp" flush="true" />
</body>
</html>
```

Example 2: Control/Include This example uses the JESI `control` tag to specify nondefault cache settings for `maxRemovalDelay` and `expiration`. In addition, it explicitly enables caching of the page, though this is already enabled by default. The first JESI `include` tag specifies an alternate page in case `order.jsp` cannot be retrieved by the ESI processor, and specifies that processing continue even if neither page can be retrieved. The second JESI `include` tag specifies no alternate page, and processing will halt if the page cannot be retrieved.

As you can see, the HTML tags that "Example 1: Control/Include" uses are not actually required.

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>

<jesi:control maxRemovalDelay="1000" expiration="300" cache="yes"/>
<jesi:include page="order.jsp" alt="alt.jsp" ignoreError="true"/>
<jesi:include page="commit.jsp" />
```

Example 3: Control/Include This is an example of an aggregate page whose output is conditional. A cookie represents the identity of a customer. If no cookie is found, the user will be shown a generic welcome page with general product information. If a cookie is found, the user will be shown a list of products according to the user profile. This list is brought into the page through a JESI `include` statement.

The JESI `control` tag also sets nondefault values for `maxRemovalDelay` and `expiration`, and explicitly enables caching for the page.

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>

<jesi:control maxRemovalDelay="1000" expiration="300" cache="yes"/>
<%
  String customerId=CookieUtil.getCookieValue(request,"customerid");

  if (customerId==null) {

    // some unknown customer
%>
    <jesi:include page="genericwelcome.jsp" />
<%
```

```
  }
  else {

    // a known customer; trying to retrieve recommended products from profiling

    String recommendedProductsDescPages[]=
               ProfileUtil.getRecommendedProductsDescURL(customerId);

    for (int i=0; i < recommendedProductsDescPages.length; i++) {
%>
    <jesi:include page="<%=recommendedProductsDescPages[i]%>" />
<%
    }
  }
%>
```

Example 4: Control/Include This example illustrates the use of JESI `include` statements with request parameters. Assume the main page is accessed through the following URL:

`http://`*`host`*`:`*`port`*`/application1/main.jsp?p2=abc`

The main page takes the parameter setting `p2=abc`. Here is the page:

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>
<html>
<jesi:control cache="no" />
<jesi:include page="a.jsp?p1=v1" />
<h3>hello ...</h3>
<jesi:include page="b.jsp" />
<h3>world ...</h3>
<jesi:include page="c.jsp?p1=v2" copyparam="true" />
</html>
```

The `a.jsp` page takes the parameter setting `p1=v1`. The `c.jsp` page takes the setting `p1=v2` as well as the setting `p2=abc`, as a result of the `copyparam` setting and the `p2` setting in the URL for the main page.

Additionally, this page is non-cacheable, according to the `cache="no"` setting. In fact, remember that you should use the `copyparam` setting in a JESI `include` tag only when the including page is non-cacheable, because the request attributes may change from one request to the next. Remember, too, that the `cache="no"` setting has no effect on the included pages—they are still cacheable by default. In other

words, each is cacheable unless it has its own JESI `control` tag with `cache="no"` for some reason.

JESI template Tag

Use the JESI `template` tag to specify caching behavior for the aggregate page, outside any fragments, in the template/fragment usage model. (See "JESI Usage Models" on page 6-7.) The corresponding HTTP header will be set according to the edge architecture specification. The aggregate content (outside the fragments) is a cacheable object, and each fragment set aside with a JESI `fragment` tag is a separate cacheable object.

Place the JESI `template` start-tag as early in the page as possible—it must appear before any other JESI tags or any buffer flushes in the page. Place the JESI `template` end-tag as late in the page as possible—it must appear after any other JESI tags in the page.

If a JESI `template` tag does not set the `cache` attribute, then cacheability of the corresponding object is according to configuration settings of the ESI processor.

The JESI `template` tag is always used together with JESI `fragment` tags. If you have no need for separate fragments, use a JESI `control` tag instead of a JESI `template` tag.

Be aware of the following:

- Do not use multiple JESI `template` tags in a single JSP page. Also do not use additional JESI `template` tags in pages that are included, through `jsp:include` functionality, into the same response object. In either case, an exception will result.
- Do not use a JESI `control` tag and a JESI `template` tag in the same page, or in separate pages that are included into the same response object. An exception will result.
- The JESI `template` tag settings have no effect on the enclosed fragments; fragments must provide their own settings.
- If a page with a JESI `template` tag depends on request parameters, consider whether you must cache the page with parameters (instead of without parameters) in the ESI server. Another alternative is to not cache the page at all (set `cache="no"`), if you anticipate that too many different request parameter values will result in too many cached entries for the page.

The JESI `template` tag has the same attributes, with the same usage, as the JESI `control` tag.

Syntax

```
<jesi:template
            [ expiration = "value" ]
            [ maxRemovalDelay = "value" ]
            [ cache = "yes" | "no" | "no-remote" ] >

...page content, jesi:fragment tags, jesi:include tags...

</jesi:template>
```

Attributes

For attribute descriptions, see "JESI control Tag" on page 6-14.

Note: If request parameters are significant to the fragment, then either the enclosing template should not be cached (`cache="no"` in the JESI `template` tag), or, in the ESI server, the fragment should be cached with parameters (instead of without parameters). In the background, a fragment, as with a page included through a JESI `include` tag, involves an additional request. Request parameters (if any) are always passed from the template to the fragment, equivalent to JESI `include` tag functionality with a setting of `copyparam="true"`. (This kind of issue is also discussed in "JESI include Tag" on page 6-15.)

JESI fragment Tag

Use one or more JESI `fragment` tags within a JESI `template` tag, between the JESI `template` start-tag and end-tag, in the template / fragment model. (See "JESI Usage Models" on page 6-7.) The JESI `fragment` tag defines separate fragments of JSP code, as desired, for caching behavior. Each fragment is a separate cacheable object.

When a particular fragment is requested through the ESI mechanism, the ESI processor will retrieve only that fragment.

Each JESI `fragment` tag specifies its own instructions to the ESI processor. If the `cache` attribute is not set, then cacheability of the corresponding object is according to the configuration settings of the ESI processor. The settings of the surrounding JESI `template` tag have no effect on the fragments.

The JESI `fragment` tag has the same attributes, with the same usage, as the JESI `control` and JESI `template` tags.

Syntax

```
<jesi:fragment
            [ expiration = "value" ]
            [ maxRemovalDelay = "value" ]
            [ cache = "yes" | "no" | "no-remote" ] >
...JSP code fragment...

</jesi:fragment>
```

Attributes

For attribute descriptions, see "JESI control Tag" on page 6-14.

Examples: Template/Fragment Model

This section contains examples of JESI tag usage in the template/fragment model.

Example 1: Template/Fragment This is a general example showing use of the JESI `template` and JESI `fragment` tags. Because only the `expiration` attribute is set in any of the tags, all other settings are according to defaults.

The aggregate content (outside the fragments), according to the JESI `template` tag, uses an expiration of 3600 seconds. This applies to all the HTML blocks because they are outside the fragments. JSP code block #1 is cached with an expiration setting of 60; JSP code block #2 is cached with the default expiration setting; and JSP code block #3 is cached with an expiration setting of 600.

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>
<jesi:template expiration="3600">
...HTML block #1...
   <jesi:fragment expiration="60">
   ...JSP code block #1...
   </jesi:fragment>
...HTML block #2...
   <jesi:fragment>
   ...JSP code block #2...
   </jesi:fragment>
...HTML block #3...
  <jesi:fragment expiration="600">
   ...JSP code block #3...
   </jesi:fragment>
...HTML block #4...
</jesi:template>
```

Example 2: Template/Fragment This example employs JESI `include` tags inside the fragments. The following are the cacheable objects for this page:

- each included page
- each fragment, outside of its included page
- the aggregate of the HTML blocks, which are all at template level outside the fragments

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>
<jesi:template expiration="3600">
...HTML block #1...
   <jesi:fragment expiration="60">
   ...JSP code block #1...
   <jesi:include page="stocks.jsp" />
   </jesi:fragment>
...HTML block #2...
   <jesi:fragment>
   ...JSP code block #2...
   <jesi:include page="/weather.jsp" />
   </jesi:fragment>
...HTML block #3...
   <jesi:fragment expiration="600">
   ...JSP code block #3...
   <jesi:include page="../sales.jsp" />
   </jesi:fragment>
...HTML block #4...
</jesi:template>
```

Tag and Subtag Descriptions for Invalidation of Cached Objects

Use the JESI `invalidate` tag and the following subtags, as appropriate, to explicitly invalidate cached objects in the ESI processor:

- JESI `object`
- JESI `cookie` (subtag of JESI `object`)
- JESI `header` (subtag of JESI `object`)

See "Invalidation of Cached Objects" on page 6-11 for an overview.

JESI invalidate Tag

You can use the JESI `invalidate` tag with its JESI `object` subtag to explicitly invalidate one or more cached objects.

Use the subtags as follows:

- Use the required JESI `object` subtag to specify what to invalidate according to URI or URI prefix.
- Optionally use the JESI `cookie` subtag or JESI `header` subtag of the JESI `object` tag to specify further criteria for what to invalidate, according to cookie or HTTP header information.

Syntax

```
<jesi:invalidate
             [ url = "url"
               username = "username"
               password = "password" ]
             [ config = "configfilename" ]
             [ output = "browser" ] >
```

Required subtag (described in "JESI object Subtag" on page 6-25):

```
 <jesi:object ... >
```

Optional subtag of JESI `object` (described in "JESI cookie Subtag" on page 6-27):

```
       <jesi:cookie ... />
```

Optional subtag of JESI `object` (described in "JESI header Subtag" on page 6-27):

```
       <jesi:header ... />

 </jesi:object>

</jesi:invalidate>
```

Either specify the user, password, and URL all through their individual tags, or all in the configuration file referred to in the `config` attribute.

Note: It is permissible to have multiple `object` tags within an `invalidate` tag.

Attributes

- `url`—Specifies the URL of the cache server. If this attribute is omitted, you must specify the URL in the JESI configuration file.
- `username`—Specifies the user name for logging in to the cache server. If this attribute is omitted, you must specify the user name in the JESI configuration file.
- `password`—Specifies the password for logging in to the cache server. If this attribute is omitted, you must specify the password in the JESI configuration file.
- `config`—Specifies a JESI configuration file. You can use this file to provide the cache server URL, user name, and password instead of using the corresponding tag attributes. Specify the location in application-relative syntax, starting with "`/`". Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for general information about application-relative syntax.
- `output`—Optionally sets an output device to receive the invalidation response from the cache server. Currently, the only supported setting is "`browser`", to show the message in the user's Web browser. If you do not set this parameter, the confirmation message will not be displayed at all.

Example: Configuration File Following is an example of a configuration file that is used instead of the `url`, `username`, and `password` attributes to set the URL and login information:

```
<?xml version="1.0" ?>
<ojsp-config>
  <web-cache>
      <url>http://yourhost.yourcompany.com:4001</url>
      <username>invalidator</username>
      <password>invpwd</password>
  </web-cache>
</ojsp-config>
```

JESI object Subtag

Use the required JESI `object` subtag of the JESI `invalidate` tag to specify cached objects to invalidate, according to either the complete URI or a URI prefix. Optionally use its JESI `cookie` subtag or JESI `header` subtag to specify further criteria for invalidation, based on cookie or HTTP header information.

Specify either the complete URI or the URI prefix in the `uri` attribute setting. Whether this field is interpreted as a full URI or as a prefix depends on the setting of the `prefix` attribute.

Syntax

```
<jesi:object uri = "uri_or_uriprefix"
           [ maxRemovalDelay = "value" ]
           [ prefix = "yes" | "no" ] >
```

Optional subtag (described in "JESI cookie Subtag" on page 6-27):

```
<jesi:cookie ... />
```

Optional subtag (described in "JESI header Subtag" on page 6-27):

```
<jesi:header ... />
```

```
</jesi:object>
```

or (if not using either subtag):

```
<jesi:object
             uri = "uri_or_uriprefix"
           [ maxRemovalDelay = "value" ]
           [ prefix = "yes" | "no"] />
```

Notes:

- It is permissible to have multiple `object` tags within an `invalidate` tag.
- It is permissible to have multiple `cookie` tags or `header` tags within an `object` tag.

Attributes

- `uri` (required)—Specifies either the complete URI of the page whose corresponding cached object is to be invalidated (if `prefix="no"`), or a URI prefix that specifies objects for multiple pages to be invalidated according to location (if `prefix="yes"`).

If a prefix is specified, then cached objects for all pages under that location are invalidated. For example, for a prefix of "/abc/def", cached objects for all pages in the corresponding directory and any subdirectories are invalidated.

- prefix—Set this to "yes" if the uri attribute is to be interpreted as a URI prefix only. Use the default "no" setting if uri is to be interpreted as a complete URI.
- maxRemovalDelay—Specifies the maximum time, in seconds, that the ESI processor can store the cached object after it has been invalidated. This is 0 by default, for immediate removal.

JESI cookie Subtag

Use the JESI cookie subtag of the JESI object tag (which is a subtag of JESI invalidate) to use cookie information as a further criterion for invalidation. This is used in addition to the URI or URI prefix setting in the JESI object tag, and possibly in addition to a JESI header tag as well.

Syntax

```
<jesi:cookie name = "cookie_name"
             value = "cookie_value" />
```

Note: It is permissible to have multiple cookie tags within an object tag.

Attributes

- name (required)—This is the name of the cookie.
- value (required)—This is the value of the cookie.

For a cached object to be invalidated, it must have a cookie that matches this name and value.

JESI header Subtag

Use the JESI header subtag of the JESI object tag (which is a subtag of JESI invalidate) to use HTTP/1.1 header information as a further criterion for invalidation. This is in addition to the URI or URI prefix setting in the JESI object tag, and possibly in addition to a JESI cookie tag as well.

Syntax

```
<jesi:header name = "header_name"
             value = "header_value" />
```

> **Note:** It is permissible to have multiple `header` tags within an `object` tag.

Attributes

- `name` (required)—This is the name of the HTTP / 1.1 header.
- `value` (required)—This is the value of the HTTP / 1.1 header.

For a cached object to be invalidated, it must have a header that matches this name and value.

Examples: Page Invalidation

This section provides examples of page invalidation using the JESI `invalidate` tag, its JESI `object` subtag, and the JESI `cookie` subtag of the JESI `object` tag.

Example 1: Page Invalidation This example invalidates a single object in the ESI processor, specified by its complete URI. (By default, `uri` specifies a full URI, not a URI prefix.) The JESI `invalidate` tag also specifies the URL for the cache server and the user name and password for login, and it specifies that the invalidation response from the cache server should be displayed in the user's browser.

```
<jesi:invalidate url="http://yourhost.yourcompany.com:4001"
                 username="invalidator" password="invpwd"
                 output="browser">
     <jesi:object uri="/images/logo.gif"/>
</jesi:invalidate>
```

Example 2: Page Invalidation This is equivalent to Example 1: Page Invalidation, but uses a configuration file to specify the cache server URL and login information.

```
<jesi:invalidate config="/myconfig.xml" output="browser">
     <jesi:object uri="/images/logo.gif"/>
</jesi:invalidate>
```

The JESI `invalidate` tag uses application-relative syntax for the configuration file. As an example, suppose `myconfig.xml` has the following content:

```
<?xml version="1.0" ?>
<ojsp-config>
  <web-cache>
      <url>http://yourhost.yourcompany.com:4001</url>
      <username>invalidator</username>
      <password>invpwd</password>
  </web-cache>
</ojsp-config>
```

Example 3: Page Invalidation This example invalidates all objects in the ESI processor, according to the URI prefix "/". It does not specify that the invalidation confirmation message be displayed in the browser, so it will not be displayed at all.

```
<jesi:invalidate url="http://yourhost.yourcompany.com:4001"
                 username="invalidator" password="invpwd">
     <jesi:object uri="/" prefix="yes"/>
</jesi:invalidate>
```

Example 4: Page Invalidation This example invalidates a single object but allows it to be served stale for up to 30 minutes (1800 seconds).

```
<jesi:invalidate url="http://yourhost.yourcompany.com:4001"
                 username="invalidator" password="invpwd">
     <jesi:object uri="/images/logo.gif" maxRemovalDelay="1800"/>
</jesi:invalidate>
```

Example 5: Page Invalidation This example specifies the same object for invalidation as Example 1: Page Invalidation, but specifies that it should be invalidated only if it has a cookie named `user_type` with value `customer`.

```
<jesi:invalidate url="http://yourhost.yourcompany.com:4001"
                 username="invalidator" password="invpwd">
     <jesi:object uri="/images/logo.gif">
          <jesi:cookie name="user_type" value="customer"/>
     </jesi:object>
</jesi:invalidate>
```

Tag Description for Page Personalization

To allow page customization when sharing the same cached page between multiple users, the ESI processor must be informed of dependencies by the page on cookie and session information. Cookie value replacement, for example, occurs in the ESI processor instead of in the Web server.

JESI personalize Tag

Use the JESI `personalize` tag to allow page customization, by informing the ESI processor of dependencies on cookie and session information.

Syntax

```
<jesi:personalize name = "cookie_name"
                [ value = "default_value" ] />
```

Attributes

- `name` (required)—Specifies the name of the cookie whose value is used as the basis for personalizing the page.
- `value`—An optional default value in case the cookie is not found. This allows the ESI processor to avoid having to go back to the Web server to look for the cookie.

Example: Page Personalization

Following is an example showing use of the JESI `personalize` tag:

```
<jesi:personalize name="user_id" value="guest" />
```

The corresponding ESI tag that is generated allows the ESI processor to find the necessary information. In this case, it looks for a cookie named `user_id` and retrieves its value. If it cannot find the cookie, it uses a default value of "`guest`". Handling this cookie-value replacement in the ESI processor avoids having to send a request to the Web server.

JESI Tag Handling and JESI-to-ESI Conversion

JESI tag handler classes, supplied as part of the JESI tag library with OC4J, provide the bridge from JSP functionality to ESI functionality. Tag handlers translate JESI tags into ESI tags and, as appropriate, generate HTTP requests for invalidation, set HTTP response headers, and so on. Be aware, however, that there is not always a simple one-to-one mapping between JESI tags and ESI tags, or between JESI tag attributes and ESI tag attributes.

Example: JESI-to-ESI Conversion for Included Pages

As an example of JESI-to-ESI conversion, consider the following JSP code:

```
<p>BEGIN</p>
<jesi:control cache="no"/>
<jesi:include page="stocks.jsp" flush="true" />
<p>
<hr>
<jesi:include page="/weather.jsp" copyparam="true" flush="true" />
<p>
<hr>
<jesi:include page="../sales.jsp?tax=local" copyparam="true" flush="true" />
<p>END</p>
```

Assume that this JSP code is part of a page with the following URL:

```
http://host:port/application1/top.jsp
```

Further assume the following request:

```
http://host:port/application1/top.jsp?city=Washington_DC
```

In this case, the JESI `include` tag handler generates ESI code such as in the following response.

In the response header:

```
Surrogate-Control: content="ESI/1.0",max-age=300+0
```

In the response body:

```
<p>BEGIN</p>
<esi:include src="/application1/stocks.jsp"/>

<p>
<hr>
```

```
<esi:include src="/weather.jsp?city=Washington_DC"/>

<p>
<hr>
<esi:include src="/sales.jsp?tax=local&city=Washington_DC"/>

<p>END</p>
```

This response is read by the ESI processor before being delivered to the client. A `Surrogate-Control` header alerts the ESI processor that the response body contains ESI code; therefore, the caching mechanism looks inside the response body for `<esi:>` tags. In addition, the `Surrogate-Control` header sets the cache expiration and maximum delay interval for the page, in this case using the default expiration of 300 and the default maximum delay of 0 because there is no JESI `control` tag to specify otherwise.

In response to each of the three `esi:include` tags, the ESI processor makes an additional request to the URL specified. Each response is included into the top-level page, and only after that is the assembled page delivered to the client. Note that the client receives one response, but the cache makes four requests to obtain it. This may seem like a lot of overhead; however, the overall efficiency will be improved if many additional requests also use the same included pages, such as `weather.jsp`. No requests for these pages are required, because they are cached separately on the ESI server.

Example: JESI-to-ESI Conversion for a Template and Fragment

Suppose that when employees connect to a corporate intranet site, the content of their pages is dynamic, except for a few features that are present in every response. In particular, there is always a footer displaying the stock chart and latest business headlines for the company, and the business headlines are obtained from an external business news site. Because all returned pages will have to include the same information, and it is expensive to obtain, it is more efficient to cache the footer on the ESI server.

The remainder of the page response is dynamic, incorporating the stock fragment in a slightly different way each time. To avoid having to rewrite the page, you can mark the footer as a JESI fragment and the enclosing page as a JESI template.

Also assume that a charity campaign is in progress, and that the organizers want to display a bar chart showing their goal amount and the current donation amount as part of all corporate pages. This information is stored in a special database and is

updated twice a day. The chart is a good candidate to be an additional JESI fragment.

Therefore, you would add a JESI `template` tag at the top of the page and use JESI `fragment` tags to enclose the fragments that are to be cached as separate entities.

Assume the URL to the corporate page is as follows:

```
http://www.bigcorp.com/employee_page.jsp
```

Further assume you have modified the page as follows:

```
<%@ taglib uri="/WEB-INF/jesitaglib.tld" prefix="jesi" %>
<jesi:template cache="no" >

<p>BEGIN</p>
... some dynamic page content...
<jesi:fragment>
This_is_the_body_of_Charity_Chart
</jesi:fragment>
... some more dynamic content...
<jesi:fragment>
This_is_the_body_of_Business_Footer
</jesi:fragment>
<p>END</p>
```

When the page is requested, an HTTP response is generated as follows.

In the response header:

```
Surrogate-Control: content="ESI/1.0",max-age=300+0,no-store
```

In the response body:

```
<p>BEGIN</p>
... some dynamic page content...
<esi:include src="/employee_page.jsp?__esi_fragment=1"/>
... some more dynamic content...
<esi:include src="/employee_page.jsp?__esi_fragment=2"/>
<p>END</p>
```

As with the JESI `include` example in "Example: JESI-to-ESI Conversion for Included Pages" on page 6-31, the ESI server is alerted by the `Surrogate-Control` response header. Note the `no-store` directive, generated because of the `cache="no"` setting in the JESI `template` tag. In addition, the default expiration of 300 and the default maximum delay of 0 are used, because the JESI `template` tag does not specify otherwise.

The ESI server makes two additional requests, where it fetches and caches the two fragments. After that, the composite page is returned to the employee. When the employee works with the page again, the dynamic content will be newly generated, but the chart and the footer will be served from the cache.

Note: `Surrogate-Control` headers are consumed by the ESI server and are not seen in the final response to the client.

7

Web Object Cache Tags and API

This chapter describes the Web Object Cache, an application-level caching mechanism supplied with OC4J. For Web applications written in Java, you can use the Web Object Cache in conjunction with the Oracle9*i*AS Web Cache for increased speed and scalability.

This chapter includes the following topics:

- Overview of the Web Object Cache
- Key Functionality of the Web Object Cache
- Attributes for Policy Specification and Use
- Web Object Cache Tag Descriptions
- Web Object Cache Servlet API Descriptions
- Cache Policy Descriptor
- Cache Repository Descriptor
- Configuration for Back-End Repository

For an overview of Web caching, including a discussion of the Oracle9*i*AS Web Cache and Oracle9*i* Application Server Java Object Cache, see "Summary of Oracle Caching Support for Web Applications" on page 1-18.

Overview of the Web Object Cache

The OC4J Web Object Cache is a mechanism that allows Web applications written in Java to capture, store, reuse, post-process, and maintain the partial and intermediate results generated by a dynamic Web page, such as a JSP or servlet. For programming interfaces, it provides a tag library (for use in JSP pages) and a Java API (for use in servlets).

The Web Object Cache works at the Java level and is closely integrated with the HTTP environment of JSP and servlet applications. Cached objects might consist of HTML or XML fragments, XML DOM objects, or Java serializable objects.

Through the Web Object Cache programming interfaces, you can decide how to split Web pages into page blocks that define separate cache objects for finer control of caching. (The terms *block* and *object* are used somewhat interchangeably in this sense.) In this way, the application itself can control life span and other behavior of individual cache entities during runtime. Application developers have the best understanding of the life cycle patterns of their application Web pages, so are best suited to determine how to split pages into cache blocks. You can specify maintenance policies for partial results either declaratively in an external file, the *cache policy descriptor*, or programmatically within the application itself.

This section covers the following topics:

Benefits of the Web Object Cache

Note: The Web Object Cache is useful in particular scenarios and does not replace the need for other caching mechanisms, including the Oracle9*i*AS Web Cache. For an overview of the Web Object Cache, and how it relates to the Oracle9*i*AS Web Cache and the Oracle9*i* Application Server Java Object Cache, including a discussion of when it is appropriate to use each one, see "Summary of Oracle Caching Support for Web Applications" on page 1-18.

Using the Web Object Cache can significantly reduce the amount of time spent in constructing page blocks or Java objects in dynamic applications, such as those with

expensive intermediate operations like querying a database and formatting or transforming the results. Subsequent queries pull the information out of the cache, so the query and formatting do not have to be repeated.

Furthermore, developers can closely control the cache programmatically, through API calls or custom JSP tags. This can include controlling when cache entries are created, what they are named, when they expire, which users can see which cached data, and what operations can be applied to cached data before the results are served to the user.

Some kinds of Web applications benefit more than others by using the Web Object Cache, depending on the nature and use of their data. For example, applications such as catalog and directory browsing, delayed stock quotes, and personalized portals would particularly benefit. Applications such as real-time stock trading or real-time stock quotes, however, would not benefit, because the data has to be updated so frequently that the overhead of the caching operations would outweigh the benefits. (In these circumstances, however, the Oracle9*i*AS Web Cache might still be useful because of its lighter overhead.)

In general, the Web Object Cache is most useful in the following situations:

- for special post-processing on cached data objects, such as XSLT or XML DOM operations
- for sharing data in a non-HTTP situation, such as reusing cached XML data or Java objects and sending the data to others through SMTP, JMS, AQ, or SOAP
- for special storage needs, such as storing cached data in a file system or database for persistent storage of data with a long lifetime
- for application-specific authorization, allowing different users to have different access rights to different data items, such as for a Web-based groupware application

  The application can have its own authorization scheme. The Web Object Cache is embedded within Java authorization logic.

Using the Web Object Cache in JSP pages, instead of in servlets, is particularly convenient. JSP code generation can save much of the development effort.

Web Object Cache Components

The Web Object Cache consists of two main components:

- the cache repository
- the cache programming interfaces

This section also provides a brief introduction to the Oracle9*i* Application Server Java Object Cache, which is the default cache repository of the Web Object Cache.

Cache Repository

The cache repository is the component that is responsible for data storage, data distribution, and cache expiration. There can be multiple repository implementations for a programmable Web cache (such as the Web Object Cache), depending on the tier and platform. For example, the file system might be used for secondary storage in the middle tier, and database tables for primary storage in the database tier.

The Web Object Cache uses the Oracle9*i* Application Server Java Object Cache as its default repository. This is a general-purpose caching service and API designed for Java application use, with objects being accessible by name.

The Java Object Cache is a powerful and flexible programming facility. There are no restrictions on the types of objects that can be cached or the original source of the objects—the management of each object is easily customizable. Each object has a set of attributes such as the following:

- how the object is loaded into the cache
- where the object is stored (in memory, on disk, or both)
- the lifetime, also known as the *time-to-live*, of the object
- whom to notify when the object is invalidated

Objects can be invalidated as a group or individually.

For more information, see the *Oracle9iAS Containers for J2EE Services Guide*.

Note: See "Configuration for Back-End Repository" on page 7-63 for information about configuring the Java Object Cache or a file system as the back-end repository for the Web Object Cache.

Cache Programming Interfaces

The front-end caching interfaces are used through JSP pages and servlets to handle HTTP processing and to direct the semantics relating to the cache policy (rules and specifications determining how the cache works).

The OC4J Web Object Cache programming interfaces can be further divided as follows:

- Web Object Cache tag library

  This is a convenient wrapper, using JSP custom tag functionality, for the Web Object Cache API. Use custom tags in a JSP page to control the caching, with the API being called through the underlying tag handler classes.

- Web Object Cache servlet API

  This is the common layer across servlets and JSP pages, dealing with the HTTP semantics and cache policy. This layer communicates with the cache repository.

This chapter describes these programming interfaces and their interaction with the cache repository. Cache tags are described in "Web Object Cache Tag Descriptions" on page 7-21. The underlying cache policy API is described in "Web Object Cache Servlet API Descriptions" on page 7-39. In servlets, you will use the underlying API; in JSP pages, you will typically use the more convenient tags.

Cache Policy and Scope

The *cache policy* is a set of specifications determining details of the cache and how it will behave. This includes the following:

- cache scope
- cache block naming rules
- data expiration rules
- cache repository name

You can set cache policy specifications (as described in "Attributes for Policy Specification and Use" on page 7-12) through any of the following:

- cache tag attributes (for JSP pages)

  See "Web Object Cache Tag Descriptions" on page 7-21.

- cache policy methods (for servlets)

  See "Web Object Cache Servlet API Descriptions" on page 7-39.

- external cache policy descriptor files (for JSP pages or servlets)

  See "Cache Policy Descriptor" on page 7-58.

A cache policy object—an instance of the `oracle.jsp.jwcache.CachePolicy` class—is created with policy settings based on these inputs. Because the expiration

policy is part of the cache policy, each `CachePolicy` object includes an attribute that is an instance of the `oracle.jsp.jwcache.ExpirationPolicy` class.

Cache data can be of either *session scope*, where it is available to only the current HTTP session, or *application scope*, where it is available to all users of the application.

For example, consider an online banking application that caches the account balance. Only the current user is interested in this information, so `session` scope is appropriate.

By contrast, consider an online store with a welcome page that issues the same general product recommendations to all users. In this case, it is appropriate for the page to use a cache that has `application` scope.

Key Functionality of the Web Object Cache

This section discusses key areas of functionality of the Web Object Cache, covering the following:

- Cache Block Naming: Implicit Versus Explicit
- Cache Block Runtime Functionality
- Data Invalidation and Expiration

Cache Block Naming: Implicit Versus Explicit

A cache block is associated with a cache block name, which can be determined either implicitly by the caching policy (generally advisable) or explicitly by your application code. For retrieval, to avoid regenerating the page fragment in question, there is a lookup of the cache block name.

For implicit naming, there are two inputs:

- the cache policy

  A cache policy API layer performs naming logic.

- the HTTP request object

  The caching logic borrows corresponding semantics from the standard Java servlet API.

For most situations, implicit naming will result in names that are sufficiently informative, because the HTTP request usually includes all the inputs to the Web application (inputs that determine what the application should generate).

Explicit naming might be desirable in some cases, however, such as when a group of users needs to share the same data. In this case, because relevant identification information may not be available directly from the user's HTTP request, an implicit cache name would not be useful. Instead, you can write code to explicitly generate a cache name that identifies the group. Preferably, the name-generation logic should still use only request parameters as input, not other states existing inside the application. This makes the semantics easier to follow and the code easier to debug.

Following is an example of explicit naming. In the `cache` tag, note the `name` attribute with a JSP expression that calls `someMethod()` to set the cache block name.

```
<ojsp:cache policy="/WEB-INF/policy1.cpd"
            name="<%= someObj.someMethod() %>" >
...static text...
<% // dynamic content ... %>
</ojsp:cache>
```

In the following example, because there is no `name` attribute in the `cache` tag, the cache block name will be determined implicitly according to the HTTP request and the cache policy:

```
<ojsp:cache policy="/WEB-INF/policy2.cpd" >
...static text...
<% // dynamic content ... %>
</ojsp:cache>
```

See "More About Cache Block Naming and the autoType Attribute" on page 7-16 for more information.

Note: Cache blocks can be nested. In this case, the logic of the inner cache block will be executed only when the content of the outer block must be regenerated.

Cloneable Cache Objects

The OC4J Web Object Cache provides an interface, `oracle.jsp.jwcache.CloneableCacheObj`, which you can implement in serializable cache objects that you want to be cloneable. For mutable objects that are cached without being serialized, cloning is useful in providing a complete and hierarchical copy of the cache object. This section explains the usefulness of cloneability, first covering some necessary background information.

Memory-Oriented Repositories Versus Secondary Storage Repositories

There are two categories of repositories that can be used as the back-end of the Web Object Cache:

- secondary storage cache repository (such as a file system repository)
- memory-oriented cache repository (such as the Oracle9*i* Application Server Java Object Cache, the default repository of the Web Object Cache)

A secondary storage repository requires Java serialization during cache operations. During storage to the cache, objects are serialized into the repository; during retrieval from the cache, they are deserialized into memory. Therefore, as a result of

the serialization / deserialization process, a complete and distinct copy of the cache object is automatically created during each cache operation.

This is not the case when you store or retrieve cache objects to or from a memory-oriented repository. With a memory-oriented repository, the identical object in the user application will be stored to the cache, or the identical object in the cache will be retrieved for the user. By default, no copy is made. If there are multiple retrievals, all retrievals share the same object.

Advantages in Cloning Copies of Cache Objects

In many cases in your applications, you will want to ensure that different retrievals use different copies of a cache object. There are two key reasons for this:

- If the identical cache object is shared across multiple retrievals, changes made to the data in one place may unintentionally affect values retrieved and used elsewhere.
- If the identical cache object is shared across multiple retrievals, then multiple Java threads may access the same object simultaneously. This would result in thread safety issues if the original object design was not thread-safe. Perhaps, for example, the object was originally intended for page-scope or request-scope usage only, where there could be only one thread for each object. This thread-behavior assumption would be violated.

To avoid these possible problems, use complete and hierarchical copies when you store and retrieve generic Java serializable data to or from a memory-oriented repository. "Complete and hierarchical" means copying not just the direct members referenced by the object, but also any indirect variables that are referenced. For example, assume an object `xyz` has a `java.util.Vector` instance as a member variable. Cloning a complete and hierarchical copy involves copying not just the `Vector` instance itself, but also all mutable objects or elements referenced by the `Vector` instance.

Use of the CloneableCacheObject Interface

If you implement the `CloneableCacheObject` interface and its `cloneCacheObj()` method in your cache objects, then the Web Object Cache will automatically call `cloneCacheObj()` to make a complete and hierarchical copy of each cache object whenever it is stored to or retrieved from a memory-oriented cache repository.

One of the OC4J demos (using the `useCacheObj` tag to cache generic Java objects) demonstrates the use of a cloneable cache object.

Cache Block Runtime Functionality

During runtime, when a Web Object Cache cache tag is encountered, the tag handler checks whether a corresponding cache object exists and was created recently enough to reuse. If so, the code in the body of the tag is not executed; instead, the cache object is reused. But if the cache object does not exist or is too old, the tag body code will be executed to generate a new object (page fragment, XML DOM object, or Java serializable object). Then this freshly generated object will be captured, such as through special buffer writing or object passing, and stored into the cache.

If computations in content generation are costly, such as for a complicated database query, and the life span of the cache is appropriate, so that the cached data is reusable, then the Web Object Cache can save significant amounts of time and system resources. Application speed and throughput will be greatly improved.

Data Invalidation and Expiration

You can set up cache blocks to expire after a specified duration or at a specified time, or they can be invalidated explicitly by a method call or tag invocation.

Cache Block Expiration

Because cache blocks mainly consist of semi-static fragments of information, the Oracle implementation does not require a tightly coherent expiration model. A looser model typically provides acceptable results and requires less synchronization overhead.

There are two categories of expiration for data in Web Object Cache blocks:

- duration (*time-to-live*)—Expiration occurs after data has been in the cache for a specified amount of time.
- fixed time/day—Expiration occurs regularly at a set time, such as at a specified time each day or on a specified day each week.

Expiration details are determined by the settings of attributes in an instance of the `oracle.jsp.jwcache.ExpirationPolicy` class. This `ExpirationPolicy` object is an attribute of the `CachePolicy` object associated with the cache block. See "Expiration Policy Attributes" on page 7-18.

In JSP pages, you can set `ExpirationPolicy` attributes through attributes of the Web Object Cache cache tags (such as `cache`, `cacheXMLObj`, or `useCacheObj`). In servlets, you can use methods of the `ExpirationPolicy` object directly. (See "ExpirationPolicy Methods" on page 7-47.) Alternatively, you can set

`ExpirationPolicy` attributes through a cache policy descriptor. (See "Cache Policy Descriptor" on page 7-58.)

Cache Block Invalidation

Instead of depending on expiration to invalidate a cache, you can invalidate it explicitly in one of the following ways:

- Use the `invalidateCache` tag. See "Web Object Cache invalidateCache Tag" on page 7-33.
- Use the overloaded `invalidateCache()`, `invalidateCacheLike()`, or `invalidateCacheOtherPathLike()` method of a `CachePolicy` instance to explicitly invalidate one or more cache blocks. See "CachePolicy Methods" on page 7-41.

Attributes for Policy Specification and Use

This section describes cache policy attributes—specifically, attributes of the `CachePolicy` and `ExpirationPolicy` classes. You can set these attributes through custom tags in JSP pages, directly through the provided Java API in servlets, or through a cache policy descriptor file.

Cache Policy Attributes

Cache policies, introduced in "Cache Policy and Scope" on page 7-5, consist of the details that determine how cache blocks behave. You can set cache policy attributes in several ways, as described in subsequent sections:

- in JSP pages through custom tags

  See "Web Object Cache Tag Descriptions" on page 7-21.

- in servlets through method calls

  See "CachePolicy Methods" on page 7-41.

- through a cache policy descriptor file

  See "Cache Policy Descriptor" on page 7-58.

Specification of cache policy settings results in the creation of a cache policy object, which includes an expiration policy object as one of its attributes. Following is abbreviated code for the `CachePolicy` class (in package `oracle.jsp.jwcache`), for illustration purposes only, showing the names of the cache policy attributes:

```
class CachePolicy
{
   boolean ignoreCache;
   int scope;
   int autoType;
   String selectedParameters[];
   String selectedCookies[];
   Date reusableTimeStamp;
   long reusableDeltaTime;
   ExpirationPolicy expirationPolicy;
   String cacheRepositoryName;
   boolean reportException;
}
```

Note: The names documented below for integer constants are for servlet usage. Different names may be used for the Web Object Cache tags. See "Web Object Cache cache Tag" on page 7-22.

Cache Policy Attribute Descriptions

Table 7–1 describes cache policy object attributes.

Table 7–1 Cache Policy Attribute Descriptions

Attribute	Type	Description
ignoreCache	boolean	This is for use during development only. When making frequent code changes, set this to `true` to disable the cache, typically so that results that were generated prior to your changes will not be returned. default: `false`
scope	int	Specifies the scope of the cache. Use the integer constant `SCOPE_SESSION` for the cache block to be accessible only to the current HTTP session, or `SCOPE_APP` for the cache block to be accessible to all HTTP sessions of the application. default: `application`
autoType	int	Specifies whether the cache block is named explicitly or implicitly, and how properties of the HTTP request are used in cache block naming (for implicit naming). The name is relevant in determining when the cache is reused for subsequent requests. See "More About Cache Block Naming and the autoType Attribute" on page 7-16. default: implicitly, according to the URI plus all parameters plus selected cookies (`TYPE_URI_ALLPARAM`)
selectedParameters[]	String []	These are selected request parameter names used in cache block naming; used in conjunction with `autoType`. See "More About Cache Block Naming and the autoType Attribute" on page 7-16. default: `null`

Table 7–1 Cache Policy Attribute Descriptions (Cont.)

Attribute	Type	Description
selectedCookies[]	String[]	These are selected cookie names used in cache block naming; used in conjunction with `autoType`. See "More About Cache Block Naming and the autoType Attribute" on page 7-16. default: `null`
reusableTimeStamp	java.util.Date	This is an absolute time limit for cache usability, where any cache block created prior to that time will not be reused. Instead, data is regenerated, but the cache block is unaltered. See "More About reusableTimeStamp and reusableDeltaTime" on page 7-17. Note the following regarding `reusableTimeStamp`: ■ It can be expressed as milliseconds between midnight, January 1, 1970 and the desired absolute time limit, or as a `java.util.Date` instance. Additional convenient formats are available through the `cache` tag—see "Web Object Cache Tag Descriptions" on page 7-21. ■ It takes precedence over `reusableDeltaTime`. ■ If its value is set as the integer constant `REUSABLE_ALWAYS` or the string constant `REUSABLE_IGNORED`, then cache entries are always reusable, for as long as they remain in the cache. ■ It is not available through the XML cache policy descriptor file. default: always reusable

Table 7–1 Cache Policy Attribute Descriptions (Cont.)

Attribute	Type	Description
reusableDeltaTime	long	This is a relative time limit for cache usability, where a cache block is not reused if the difference between cache block creation time and current time is greater than `reusableDeltaTime`. Instead, data is regenerated, but the cache block is unaltered. See "More About reusableTimeStamp and reusableDeltaTime" on page 7-17. Note the following regarding `reusableDeltaTime`: ■ It is specified in seconds. ■ The `reusableTimeStamp` attribute overrides it. ■ If its value is set as the integer constant `REUSABLE_ALWAYS` or the string constant `REUSABLE_IGNORED`, then cache entries are always reusable, for as long as they remain in the cache. default: always reusable
expirationPolicy	ExpirationPolicy	This is an expiration policy object (an instance of `oracle.jsp.jwcache.ExpirationPolicy`), which specifies circumstances under which the repository will remove cache blocks from storage. default: the default expiration policy object For information about expiration policy objects, parameters, and defaults, see "Expiration Policy Attributes" on page 7-18.
cacheRepositoryName	String	This is the name of the cache repository. Each cache policy can use its own repository. The configurations of cache repositories are defined in the `/WEB-INF/wcache.xml` file. default: "DefaultCacheRepository"
reportException	boolean	A `false` setting of this attribute results in most cache operation failures being silent, without any exception being reported to the browser. Default: `true`

More About Cache Block Naming and the autoType Attribute

As discussed in "Cache Block Naming: Implicit Versus Explicit" on page 7-7, cache blocks can be named either implicitly, sometimes called *auto-naming*, or explicitly, sometimes called *user-naming*.

More specifically, there are six ways for cache blocks to be named. Explicit naming is the first way. Specify this with an `autoType` setting of `TYPE_USERSPECIFIED` (an integer constant).

The other five ways are variations of implicit naming:

- implicit naming with only the request URI being used in the name

  Specify this with an `autoType` setting of `TYPE_URI_ONLY`.

- implicit naming according to the following:

  request URI + query string + selected cookies

  Specify this with an `autoType` setting of `TYPE_URI_QUERYSTR`. Specify the cookies in the `selectedCookies[]` attribute.

- implicit naming according to the following:

  request URI + all parameters + selected cookies (**default**)

  Specify this with an `autoType` setting of `TYPE_URI_ALLPARAM`. Specify the cookies in the `selectedCookies[]` attribute.

- implicit naming according to the following:

  request URI + selected parameters + selected cookies

  Specify this with an `autoType` setting of `TYPE_URI_SELECTEDPARAM`. Specify the parameters in the `selectedParameters[]` attribute and the cookies in the `selectedCookies[]` attribute.

- implicit naming according to the following:

  request URI + all but excluded parameters + selected cookies

  Specify this with an `autoType` setting of `TYPE_URI_EXCLUDEDPARAM`. Specify the cookies in the `selectedCookies[]` attribute and the excluded parameters in the `selectedParameters[]` attribute.

As an example, assume that you have developed a JSP page, `welcome.jsp`, with a personalized greeting for each user. The data with the personalized greeting is the only cache block in the page.

Further assume that you have specified "request URI + selected parameters + selected cookies" naming, with `user` as the only selected parameter for cache block naming and no selected cookies for naming.

Now assume the page is requested as follows:

`http://host:port/a.jsp?user=Amy`

In this case, `a.jsp?user=Amy` becomes the cache block name.

Now assume that the page is later requested by another user, as follows:

`http://host:port/a.jsp?user=Brian`

This will not reuse the "Amy" cache, because the value of `user` is different. Instead, a new cache block is created with `a.jsp?user=Brian` as the name.

Now assume a later request by the first user, as follows:

`http://host:port/a.jsp?mypar=3&user=Amy`

Because the user is again Amy, this request will reuse the first cache, displaying Amy's customized information without having to regenerate it. The `mypar` parameter is irrelevant to the caching mechanism because it was not included in the `selectedParameters[]` list of the cache policy object, presumably because you determined that the value of `mypar` is not relevant in terms of cacheable page output.

Now assume the following subsequent request:

`http://host:port/a.jsp?yourpar=4&user=Brian&hello=true&foo=barfly`

Because the user is again Brian, this request will reuse the second cache, displaying Brian's customized information without having to regenerate it. The `yourpar`, `hello`, and `foo` parameters are irrelevant to the caching mechanism because they were not included in the `selectedParameters[]` list of the cache policy object.

More About reusableTimeStamp and reusableDeltaTime

Be aware that the concept of *reusable* is different than the concept of *time-to-live* (TTL) and is intended for more advanced use. Time-to-live, which controls the general lifetime of a cache, is described in "Expiration Policy Attributes" on page 7-18. Usually time-to-live is all that is required to appropriately limit the use of cached data.

The attributes for reusability—`reusableTimeStamp` and `reusableDeltaTime`—are intended for more specialized use and do not affect the

expiration or invalidation of cached data. As an example, consider a situation where different users have different requirements for how up-to-date a Web report is. Assume that most users can accept a report produced anytime within the past day, and that they all want to be looking at the same version so they can compare figures. An appropriate `TTL` value, then, would be "one day".

Also presume, however, that there is a small group of privileged users for whom the data is much more time-sensitive. They want to have information that is no more than one hour old.

In this case, although `TTL` is set to "one day" for all users, there can be a `reusableDeltaTime` setting of "one hour" for the privileged users, which will result in the cache not being used for them if the data is more than one hour old. Remember, though, that `reusableTimeStamp` and `reusableDeltaTime` do *not* expire the cache or otherwise affect it—the cached data can still be used for non-privileged users, according to the time-to-live.

It is up to the application logic to set appropriate values of `reusableTimeStamp` and `reusableDeltaTime` for the privileged user group.

Expiration Policy Attributes

Expiration policies are introduced in "Data Invalidation and Expiration" on page 7-10. Expiration policies contain the details that determine when cache blocks expire, at which point their data should no longer be used and the data should be regenerated instead. (Note that for most discussion, you can think of the expiration policies as being part of the cache policies.) `ExpirationPolicy` attributes, as with `CachePolicy` attributes, can be set in any of the following ways:

- in JSP pages through custom tags

  See "Web Object Cache Tag Descriptions" on page 7-21.

- in servlets through method calls

  See "ExpirationPolicy Methods" on page 7-47.

- through a cache policy descriptor file

  See "Cache Policy Descriptor" on page 7-58.

The following abbreviated code for the `ExpirationPolicy` class (in package `oracle.jsp.jwcache`), provided for illustration purposes only, shows the names of the expiration policy attributes:

```
class ExpirationPolicy
{
```

```
   int expirationType;
   long TTL;
   long timeInaDay;
   int dayInaWeek;
   int dayInaMonth;
   boolean writeThrough;
}
```

Table 7–2 describes the expiration policy object attributes.

Note: The names documented below for integer constants are for servlet usage. Different names may be used for the Web Object Cache tags. See "Web Object Cache cache Tag" on page 7-22.

Table 7–2 Expiration Policy Attribute Descriptions

Attribute	Type	Description
expirationType	int	This is the type of expiration policy—one of the following (where `TYPE_`*XXX* values are integer constants): ▪ time-to-live, to expire after a certain amount of time (according to the `TTL` attribute), specified with an `expirationType` setting of `TYPE_TTL` ▪ daily, to expire within a day at a certain time (according to the `timeInaDay` attribute), specified with an `expirationType` setting of `TYPE_DAILY` ▪ weekly, to expire within a week on a certain day at a certain time (according to the `dayInaWeek` and `timeInaDay` attributes), specified with an `expirationType` setting of `TYPE_WEEKLY` ▪ monthly, to expire within a month on a certain date at a certain time (according to the `dayInaMonth` and `timeInaDay` attributes), specified with an `expirationType` setting of `TYPE_MONTHLY` default: time-to-live
TTL	long	This is time-to-live—the amount of time the cache block is good for, expressed in seconds. The value must be a positive number. default: 300 (5 minutes)

Table 7–2 Expiration Policy Attribute Descriptions (Cont.)

Attribute	Type	Description
timeInaDay	long	This is the time of day used for daily, weekly, or monthly expiration, expressed in seconds from midnight—0 is 00:00:00 (midnight); 86399 is 23:59:59. default: 300 (00:05:00); ignored if `expirationType=TYPE_TTL`
dayInaWeek	int	This is the day of the week for weekly expiration, at the specified `timeInaDay`—`WEEKLY_SUNDAY`, `WEEKLY_MONDAY`, `WEEKLY_TUESDAY`, `WEEKLY_WEDNESDAY`, `WEEKLY_THURSDAY`, `WEEKLY_FRIDAY`, or `WEEKLY_SATURDAY` (integer constants). default: Wednesday; ignored unless `expirationType=TYPE_WEEKLY`
dayInaMonth	int	This is the date of the month for monthly expiration, such as 10 for the 10th of each month, at the specified `timeInaDay`. The maximum setting is the number of days in the month when the cache block is created. For example, if a cache block is created in June and `dayInaMonth` has a setting of 31, then its effective value will be 30. default: 10; ignored unless `expirationType=TYPE_MONTHLY`
writeThrough	boolean	This flag specifies whether the cache repository should treat the cache entry as a write-through cache, writing it immediately into secondary storage such as a file system or database. Set this to `true` for write-through mode. A write-through cache will survive a server restart or power failure. With a `false` setting, the cache entry is treated as a delayed-write cache, which is appropriate for caches that have a short life span, such as 5 or 10 minutes, and are not overly expensive to recompute. Note that some cache repositories may not support write-through mode; others may always use write-through mode. default: `true`

Web Object Cache Tag Descriptions

From JSP pages, you can specify cache policy settings, expiration policy settings, and explicit invalidation through custom tags provided with OC4J. Discussion is organized into the following categories:

- Cache Tag Descriptions
- Cache Invalidation Tag Description

The Web Object Cache classes are in the file `ojsputil.jar`, which is supplied with OC4J. Verify that this file is installed and in your classpath. Also, to use the Oracle9*i* Application Server Java Object Cache as the back-end repository, the file `cache.jar` must be installed and in your classpath. This file also comes with OC4J.

To use the Web Object Cache tag library, the tag library descriptor file, `jwcache.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "ojsp:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.
- The Web Object Cache tag library is a standard library. For general information about the standard JavaServer Pages tag library framework, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

Cache Tag Descriptions

This section describes the following tags:

- `cache`

  This tag is for general character-based caching (HTML or XML fragments).

- `cacheXMLObj`

  This tag is for caching XML objects; its parameters are a superset of the `cache` tag parameters. Because the Web Object Cache is particularly useful when post-processing XML documents, you will likely use the `cacheXMLObj` tag more often than the `cache` tag.

- `useCacheObj`

  This tag is for general caching of Java serializable objects. Some of the semantics and syntax are patterned after the standard `jsp:useBean` tag.

- `cacheInclude`

  This tag combines the functionality of the `cache` tag with that of the standard `jsp:include` tag.

This section also describes conditional execution of code within the cache tags, possible resulting problems, and the workaround of dividing cache blocks into individual JSP pages and, optionally, using the `cacheInclude` tag to combine the pages together appropriately.

Web Object Cache cache Tag

This section documents the syntax and attributes of the `cache` tag, which you can use to set up general caching in a JSP application, in contrast to the caching of XML objects or Java serializable object.

> **Note:** For caching XML objects, use the `cacheXMLObj` tag instead. For caching Java serializable objects, use the `useCacheObj` tag. These tags support all the `cache` tag attributes described here. See "Web Object Cache cacheXMLObj Tag" on page 7-27 and "Web Object Cache useCacheObj Tag" on page 7-29.

Syntax

```
<ojsp:cache
   [ policy = "filename" ]
   [ ignoreCache = "true" | "false" ]
   [ invalidateCache = "true" | "false" ]
   [ scope = "application" | "session" ]
   [ autoType = "user" | "URI" | "URI_query" | "URI_allParam" |
                "URI_selectedParam" | "URI_excludedParam" ]
   [ selectedParam = "space-delimited_string_of_parameter_names" ]
   [ selectedCookies = "space-delimited_string_of_cookie_names" ]
```

```
   [ reusableTimeStamp = "yyyy.mm.dd hh:mm:ss z" |
                         "yyyy.mm.dd hh:mm:ss" | "yyyy.mm.dd"| "ignored" ]
   [ reusableDeltaTime = "number" | "ignored" ]
   [ name = "blockname" ]
   [ expirationType = "TTL" | "daily" | "weekly" | "monthly" ]
   [ TTL = "number" ]
   [ timeInaDay = "number" ]
   [ dayInaWeek = "Sunday" | "Monday" | "Tuesday" | "Wednesday" |
                  "Thursday" | "Friday" | "Saturday" ]
   [ dayInaMonth = "number" ]
   [ writeThrough = "true" | "false" ]
   [ printCacheBlockInfo = "true" | "false" ]
   [ printCachePolicy = "true" | "false" ]
   [ cacheRepositoryName = "name" ]
   [ reportException = "true" | "false" ] >

...Code for cache block...

</ojsp:cache>
```

Notes:

- This tag can optionally be in the form of a single tag with no body:

  ```
  <ojsp:cache ... />
  ```

- Key default values are as follows: `TTL` 300 seconds; `dayInaMonth` 10 (10th of the month); cache repository name `DefaultCacheRepository`.

Attributes

Most of the parameters of the `cache` tag correspond to attributes in the `CachePolicy` or `ExpirationPolicy` class, described earlier in this chapter (as referenced below).

- `policy`—Optionally use this to specify a cache policy descriptor, the settings of which would be used in defining the cache policy. You can use a cache policy descriptor instead of using the various individual cache tag attribute settings, or to establish default values that you can optionally override through tag attribute settings.

Specify the descriptor file name according to JSP standard application-relative syntax. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about application-relative syntax.

Here is a simple example of a cache policy descriptor:

```
<!--
test-policy.cpd
-->

<cachePolicy scope="application">
   <expirationPolicy expirationType="TTL" TTL="25" timeInaDay="00:10:00"
                     writeThrough="true" />
</cachePolicy>
```

See "Cache Policy Descriptor" on page 7-58 for more information.

- `ignoreCache`—See "Cache Policy Attributes" on page 7-12.
- `invalidateCache`—Enable this flag for the corresponding cache block (any pre-existing cache block with the same name) to first be invalidated. This is particularly useful where implicit cache block naming is used, but can also be used for explicit names by specifying the cache block name in the `name` attribute of the `cache` tag. The default setting is "`false`".

> **Note:** Do not confuse this attribute with the more general-purpose `invalidateCache` tag. See "Web Object Cache invalidateCache Tag" on page 7-33. The `invalidateCache` attribute is for more specialized or advanced use to invalidate individual cache blocks.

- `scope`—See "Cache Policy Attributes" on page 7-12.
- `autoType`—See "Cache Policy Attributes" on page 7-12. The correspondence between tag attribute settings and class attribute values (integer constants) is as follows:
  - `user` is equivalent to `TYPE_USERSPECIFIED`.
  - `URI` is equivalent to `TYPE_URI_ONLY`.
  - `URI_query` is equivalent to `TYPE_URI_QUERYSTR`.
  - `URI_allParam` is equivalent to `TYPE_URI_ALLPARAM`.
  - `URI_selectedParam` is equivalent to `TYPE_URI_SELECTEDPARAM`.

  - `URI_excludedParam` is equivalent to `TYPE_URI_EXCLUDEDPARAM`.
- `selectedParam`—See "Cache Policy Attributes" on page 7-12.
- `selectedCookies`—See "Cache Policy Attributes" on page 7-12.
- `reusableTimeStamp`—See "Cache Policy Attributes" on page 7-12.
- `reusableDeltaTime`—See "Cache Policy Attributes" on page 7-12.
- `name`—Where you use explicit cache-block naming, use the `name` parameter to specify the block name.
- `expirationType`—See "Expiration Policy Attributes" on page 7-18.
- `TTL`—See "Expiration Policy Attributes" on page 7-18.
- `timeInaDay`—See "Expiration Policy Attributes" on page 7-18.
- `dayInaWeek`—See "Expiration Policy Attributes" on page 7-18.
- `dayInaMonth`—See "Expiration Policy Attributes" on page 7-18.
- `writeThrough`—See "Expiration Policy Attributes" on page 7-18.
- `printCacheBlockInfo` (for debugging)—Enabling this parameter results in printing of the internal cache name, creation time, and expiration time of the cache block, within HTML / XML comment constructs. The default setting is "`false`".
- `printCachePolicy` (for debugging)—Enabling this parameter results in printing of the values of all cache policy attributes for this cache block, within HTML / XML comment constructs. The default setting is "`false`".
- `cacheRepositoryName`—See "Cache Policy Attributes" on page 7-12.
- `reportException`—See "Cache Policy Attributes" on page 7-12.

Usage Notes

- The `name` attribute is relevant only when `autoType` is set to `user`.
- The `selectedParam` attribute is relevant only when `autoType` is set to `URI_selectedParam` or `URI_excludedParam`.
- The `selectedCookies` attribute is not relevant when `autoType` is set to `user` or `URI`.
- The `timeInaDay` attribute is not relevant when `expirationType` is set to `TTL`.

- The `dayInaWeek` attribute is relevant only when `expirationType` is set to `weekly`.
- The `dayInaMonth` attribute is relevant only when `expirationType` is set to `monthly`.

Example: cache Tag

This example lists and caches a set of items, using the `cache` tag.

```
<%@ taglib uri="/WEB-INF/jwcache.tld" prefix="ojsp" %>
<title>listitem.jsp</title>
<%
   String itemid=request.getParameter("itemid");
   if (itemid==null) {
     out.println("Please select a category from the above drop down box.");
     return;
   }
%>
<% long l1=(new java.util.Date()).getTime(); %>
<ojsp:cache autoType="URI_selectedParam" selectedParam="itemid"
  printCacheBlockInfo="true" printCachePolicy="true"
  policy="/WEB-INF/test-policy.cpd"
>
   Item List: <b><%= itemid %></b><br>
   Time: <%= new java.util.Date() %>
   <br>
   <jsp:useBean class="java.util.Hashtable" id="table" scope="application" />
   <hr>
   <%
     Vector list=(Vector) table.get(itemid);
     if (list==null) {
       out.println("No such item!");
     }
     else {
       for (int i=0; i<list.size(); i++) {
   %>
   <%= list.elementAt(i) %><br>
   <%
       }
     }
   %>
   timestamp:<%= new java.util.Date() %>
   <br>
</ojsp:cache>
<% long l2=(new java.util.Date()).getTime(); %>
```

```
Time for general cache operation:<%= l2-l1 %>
<br>
```

Web Object Cache cacheXMLObj Tag

Generally speaking, use the `cacheXMLObj` tag instead of the `cache` tag if you are caching XML DOM objects.

The `cacheXMLObj` tag supports all the `cache` tag attributes described in "Web Object Cache cache Tag" on page 7-22, as well as the attributes described here.

Syntax (in addition to that of the cache tag)

```
<ojsp:cacheXMLObj
   ...
   [ fromXMLObjName = "objectname" ]
   [ toXMLObjName = "objectname" ]
   [ toWriter = "true" | "false" ] >

...Code for cache block...

</ojsp:cacheXMLObj>
```

Notes:

- This tag can optionally be in the form of a single tag with no body:

  ```
  <ojsp:cacheXMLObj ... />
  ```

- For convenience, this tag is duplicated in the XML tag library, being defined in the `xml.tld` tag library descriptor file.
- This tag can act as both an XML producer and an XML consumer. Do not use `fromXMLObjName` and `toXMLObjName` if the XML object is being passed implicitly. (See "XML Producers and XML Consumers" on page 5-2.)

Attributes (in addition to those of the cache tag)

- `fromXMLObjName`—For explicit passing, specify the name of the XML input object being passed to the cache (from the `pageContext` object).

- `toXMLObjName`—For explicit passing, specify the name of the XML output object being passed from the cache (to the `pageContext` object).
- `toWriter`—Set this to "`true`" to write the XML object to a JSP writer to output directly to the user's browser. The default value is "`false`".

Note: The `cacheXMLObj` tag is one of several custom tags supplied with OC4J that are XML-related, meaning these tags sometimes (or always) take an XML object as input or create one as output. Other such tags include the SQL library `dbQuery` tag, which can output query results as an XML DOM object, and the XML library `transform` and `styleSheet` tags, which can take an XML object as input and use XSLT transformation to create another XML object or a JSP writer as output. These tags are consistent in having a `fromXMLObjName` attribute and a `toXMLObjName` attribute for explicit passing of XML data. For general information, see "XML Producers and XML Consumers" on page 5-2.

Example: cacheXMLObj Tag

This example uses Web Object Cache tags, JESI tags, and tags from the XML and SQL tag libraries. (For JESI tag descriptions, see "Oracle JESI Tag Descriptions" on page 6-13. For a description of the XML `transform` tag, see "XML Utility Tags" on page 5-5. For SQL tag descriptions, see "SQL Tags for Data Access" on page 4-16.)

The SQL `dbOpen` and SQL `dbQuery` tags connect to the database and execute a query. The `cacheXMLObj` tag caches the XML DOM object produced by the query—in subsequent executions (for output through different stylesheets, for example), the query does not have to be reexecuted, because the DOM object can be retrieved from the Web Object Cache. The XML `transform` tag outputs the query results according to an XML stylesheet (specified through a variable). The JESI `fragment` tag encloses HTML output to be cached (which does not require application-level caching). The JESI `template` tag disables caching outside the fragment (through the `cache="no"` setting).

```
<jesi:template cache="no">
<% String userStyleLoc="style/rowset.xsl"; %>
<h3>Transform DBQuery Tag Example</h3>
<h4>Current Time=<%= new java.util.Date() %></h4>
<jesi:fragment expiration="60">
<!-- You can cache HTML in Oracle9iAS Web Cache with JESI
  or you can cache it in Oracle Web Object Cache -->
```

```
<h4>Cached Time=<%= new java.util.Date() %></h4>
<sql:dbOpen connId="conn1" URL="<%= connStr %>"
              user="scott" password="tiger" />
<xml:transform href="<%= userStyleLoc %>" >
<%-- The XML DOM object is produced by dbQuery
  And, the DOM object is cached in Oracle Web Object Cache.
  XSLT is performed on the cached object. --%>
  <ojsp:cacheXMLObj TTL="60" toWriter="false">
    <sql:dbQuery connId="conn1" output="xml" queryId="myquery" >
       select ENAME, EMPNO from EMP
    </sql:dbQuery>
  </ojsp:cacheXMLObj>
</xml:transform>
<sql:dbCloseQuery queryId="myquery" />
<sql:dbClose connId="con1" />
</jesi:fragment>
</jesi:template>
```

Web Object Cache useCacheObj Tag

Use the `useCacheObj` tag to cache any Java serializable object.

The `useCacheObj` tag supports all the `cache` tag attributes described in "Web Object Cache cache Tag" on page 7-22, as well as the attributes described here.

Syntax (in addition to that of the cache tag)

```
<ojsp:useCacheObj
   ...
     type="classname"
     id = "instancename"
   [ cacheScope = "application" | "session" ] >

...Code for cache block...

</ojsp:useCacheObj>
```

Notes:

- This tag can optionally be in the form of a single tag with no body:

  ```
  <ojsp:useCacheObj ... />
  ```

- The `id` and `type` attributes are not request-time attributes, so cannot be set using JSP runtime expressions.

Attributes (in addition to those of the cache tag)

- `type` (required)—Specify the class name of the Java object to cache.
- `id` (required)—Specify the instance name of the Java object to cache.
- `cacheScope`—This attribute has the same usage as the `scope` attribute in the `cache` and `cacheXMLObj` tags. See "Cache Policy Attributes" on page 7-12.

The `type` and `id` attributes here are used similarly to the `type` (or `class`) and `id` attributes in a standard `jsp:useBean` tag.

Example: useCacheObj Tag

```
<ojsp:useCacheObj id="a2" policy="/WEB-INF/test-policy.cpd"
  type="examples.RStrArray" >
<%
   // create a temp writeable array
   WStrArray tmpa2=new WStrArray(3);
   tmpa2.setStr(2,request.getParameter("testing4"));
   tmpa2.setStr(1,"def");
   tmpa2.setStr(0, (new java.util.Date()).toString() );
   // create a readonly copy for the cache
   a2=new RStrArray(tmpa2);
   // storing the a2 into pagecontext
   // so useCacheObj tag can pick it up
   pageContext.setAttribute("a2",a2);
%>
</ojsp:useCacheObj>
```

Conditional Execution of Code Inside the Cache Tags

Be aware that code inside a cache tag (`cache`, `cacheXMLObj`, or `useCacheObj`) is executed conditionally. In particular:

- Any code inside a cache tag is executed only when the associated cache block is *not* reused.

  Consider the following example:

  ```
  <% String str=null; %>
  <% ojsp:useCacheObj ... >
     <% str = "abc"; //...more Java code...%>
  </ojsp:useCacheObj>
  <% out.print(str.length()); // May cause null pointer exception
  ```

  If the cache is available and reused, the code to properly initialize the string `str` is not executed.

- If you put a method-based variable declaration inside a cache tag, the variable is not available outside the tag.

  Consider the following example:

  ```
  <ojsp:useCacheObj ... >
     <% String str = "abc"; //...more Java code...%>
  </ojsp:useCacheObj>
  <% // String str will not be available here %>
  ```

If you are using the `cache` tag (not `cacheXMLObj` or `useCacheObj`), it might be helpful to break your cache blocks into separate JSP pages so that you would be less likely to fall into this type of situation. In this case, each cache block would be represented by its own URI, and you could use dynamic-include functionality to combine the pages together as desired.

To make this more convenient, Oracle also provides the `cacheInclude` tag, described in the following section, "Web Object Cache cacheInclude Tag".

Web Object Cache cacheInclude Tag

The `cacheInclude` tag combines functionality of the `cache` tag (but not the `cacheXMLObj` tag or `useCacheObj` tag) and the standard `jsp:include` tag.

There are a number of advantages in putting cache blocks into separate pages and using `cacheInclude`, including general considerations of modularity and clarity as well as the issues discussed in the preceding section, "Conditional Execution of Code Inside the Cache Tags".

Be aware of the following limitations, however:

- You cannot use a runtime JSP expression in the `cacheInclude` tag.
- You must use implicit cache-block naming for the cache block.
- There is no `flush` parameter (unlike for the standard `jsp:include` tag).

If any of these limitations presents a problem, then use separate `cache` and `include` tags.

Also be aware of an important difference between the `cacheInclude` tag and the JESI `include` tag. (See "JESI include Tag" on page 6-15 for information about that tag.) Because the Oracle9*i*AS Web Cache is in a different caching layer than the Web Object Cache, the including page and included page for a JESI `include` tag cannot share the same request object. There is no such limitation with the `cacheInclude` tag, however—the including page and included page share the same request object, so beans and attributes of `request` scope can be passed between the two pages.

Syntax

```
<ojsp:cacheInclude
     policy = "filename"
     page = "URI"
   [ printCacheBlockInfo = "true" | "false" ]
   [ reportException = "true" | "false" ] >

...Code for cache block...

</ojsp:cacheInclude>
```

> **Note:** For the `cacheInclude` tag, because `policy` and `page` are not request-time attributes, you do not have the option of determining their values through JSP expressions. (Be aware that `policy` *is* a request-time attribute for the `cache`, `cacheXMLObj`, and `useCacheObj` tags.)

Attributes

- `policy` (required)—You must use a cache policy descriptor file to specify cache policy settings; individual parameter settings are not supported.
- `page` (required)—Use the `page` attribute to specify the URI of the page to dynamically include, as with a standard `jsp:include` tag.

- `printCacheBlockInfo` (for debugging)—See "Web Object Cache cache Tag" on page 7-22.
- `reportException`—See "Cache Policy Attributes" on page 7-12.

Usage Notes

Consider the following `cacheInclude` tag usage:

```
<ojsp:cacheInclude page="anotherPage.jsp" policy="foo.cpd" >
```

This is equivalent to the following:

```
<ojsp:cache policy="foo.cpd" >
   <% pageContext.include("anotherPage.jsp"); %>
</ojsp:cache>
```

or the following:

```
<jsp:include page="anotherPage.jsp" flush="true" />
```

where `anotherPage.jsp` consists of the following:

```
<ojsp:cache policy="foo.cpd" >
...anotherPage.jsp contents...
</ojsp:cache>
```

Cache Invalidation Tag Description

This section describes how to use the `invalidateCache` tag.

Web Object Cache invalidateCache Tag

To explicitly invalidate a cache block through program logic, you can use the `invalidateCache` tag. This section documents the syntax and attributes of this tag.

Notes:

- The `invalidateCache` tag does not accept new cookies; it can use only existing cookies of the current HTTP request. For information about inputting new cookies, see "CachePolicy Methods" on page 7-41.
- Do not confuse the `invalidateCache` tag with the `invalidateCache` attribute of the cache tags. The attribute is of more limited use—to invalidate the pre-existing cache object.

Syntax

```
<ojsp:invalidateCache
   [ policy = "filename" ]
   [ ignoreCache = "true" | "false" ]
   [ scope = "application" | "session" ]
   [ autoType = "user" | "URI" | "URI_query" | "URI_allParam" |
                "URI_selectedParam" | "URI_excludedParam" ]
   [ selectedParam = "space-delimited_string_of_parameter_names" ]
   [ selectedCookies = "space-delimited_string_of_cookie_names" ]
   [ name = "blockname" ]
   [ invalidateNameLike = "true" | "false" ]
   [ page = "URI" ]
   [ autoInvalidateLevel = "application" | "page" | "param" | "cookie" ]
   [ cacheRepositoryName = "name" ]
   [ reportException = "true" | "false" ] />
```

Note: The default value of `autoInvalidateLevel` depends on specifics of the page URI. See "Use of page and autoInvalidateLevel" on page 7-36.

Attributes

Most parameters of the `invalidateCache` tag also exist in the `cache` and `cacheXMLObj` tags and are used in the same way, as described earlier in this chapter (and as referenced below).

- `policy`—See "Web Object Cache cache Tag" on page 7-22.
- `ignoreCache`—See "Cache Policy Attributes" on page 7-12.

- `scope`—See "Cache Policy Attributes" on page 7-12.
- `autoType`—See "Cache Policy Attributes" on page 7-12. The correspondence between tag attribute settings and class attribute values (integer constants) is as follows:
  - `user` is equivalent to `TYPE_USERSPECIFIED`.
  - `URI` is equivalent to `TYPE_URI_ONLY`.
  - `URI_query` is equivalent to `TYPE_URI_QUERYSTR`.
  - `URI_allParam` is equivalent to `TYPE_URI_ALLPARAM`.
  - `URI_selectedParam` is equivalent to `TYPE_URI_SELECTEDPARAM`.
  - `URI_excludedParam` is equivalent to `TYPE_URI_EXCLUDEDPARAM`.
- `selectedParam`—See "Cache Policy Attributes" on page 7-12.
- `selectedCookies`—See "Cache Policy Attributes" on page 7-12.
- `name`—Use this with `invalidateNameLike` to invalidate one or more cache blocks that were named through explicit cache-block naming, according to the instructions in "Use of name and invalidateNameLike" below.
- `invalidateNameLike`—Use this with `name` to invalidate one or more cache blocks that were named through explicit cache-block naming, according to the instructions in "Use of name and invalidateNameLike" below. The default setting is "`false`".
- `page`—Specify a page-relative or application-relative URI. Use this with `autoInvalidateLevel` to invalidate one or more cache blocks that were named through implicit cache-block naming, according to the instructions in "Use of page and autoInvalidateLevel" below.
- `autoInvalidateLevel`—Use this with `page` to invalidate one or more cache blocks that were named through implicit cache-block naming, according to the instructions in "Use of page and autoInvalidateLevel" below.
- `cacheRepositoryName`—See "Cache Policy Attributes" on page 7-12.
- `reportException`—See "Cache Policy Attributes" on page 7-12.

Use of name and invalidateNameLike To invalidate one or more cache blocks that were named through *explicit* cache-block naming, use the `name` and `invalidateNameLike` attributes together, as follows:

- If `invalidateNameLike="false"`, then use the `name` parameter to specify the name of a single cache block to invalidate.
- If `invalidateNameLike="true"`, and the underlying cache repository supports wild card characters, then you can use the wildcard "*" character in the `name` parameter to invalidate multiple cache blocks whose names fit the criteria. (The Oracle9*i* Application Server Java Object Cache currently does *not* support wild card characters.)

Use of page and autoInvalidateLevel To invalidate one or more cache blocks that were named through *implicit* cache-block naming, use the `page` and `autoInvalidateLevel` attributes together.

Use the `page` attribute to specify the appropriate URI of the Web page. (With implicit naming, cache block names are based on Web page URIs.)

Use `autoInvalidateLevel` to specify the scope of invalidation—`application` scope, `page` scope, `parameter` scope, or `cookie` scope—as follows:

- If `autoInvalidateLevel="application"`, then all cache blocks associated with the application that the page belongs to will be invalidated.

  For example, if there is an application under the `/mycontext` context path, and `autoInvalidateLevel="application"`, then all cache entries of all pages under `http://`*`host`*`:`*`port`*`/mycontext` will be invalidated.

  Here is a corresponding usage example:

  ```
  <ojsp:invalidateCache page="/" autoInvalidateLevel="application" />
  ```

- If `autoInvalidateLevel="page"`, then all cache block entries associated with the page will be invalidated. Consider the following example:

  ```
  http://host:port/mycontext/mypage01.jsp?foo=bar
  ```

  For this request, if `autoInvalidate="page"`, then all cache entries of `mypage01.jsp` will be invalidated, regardless of what request parameters and cookies they are associated with. This includes cache blocks associated with the following, for example:

  ```
  http://host:port/mycontext/mypage01.jsp?p1=v1
  ```

Here is a corresponding usage example:

```
<ojsp:invalidateCache page="/mypage01.jsp" autoInvalidateLevel="page" />
```

- If `autoInvalidateLevel="param"`, then all cache entries of the page that have the identical selected parameter names and values will be invalidated, regardless of what cookies they are associated with.

  For example, consider the following:

  ```
  <ojsp:invalidateCache policy="/WEB-INF/c1.cpd"
                        page="/mypage01.jsp?foo=bar"
                        autoInvalidateLevel="param" />
  ```

  In this case, cache blocks associated with the following, for example, will *not* be invalidated:

  `http://`*`host`*`:`*`port`*`/mycontext/mypage01.jsp?foo=bar2`

  However, cache blocks associated with the following *will* be invalidated, regardless of what cookies they are associated with:

  `http://`*`host`*`:`*`port`*`/mycontext/mypage01.jsp?foo=bar`

  Continuing this example, consider the following:

  `http://`*`host`*`:`*`port`*`/mycontext/mypage01.jsp?foo=bar&p1=v1`

  Cache blocks associated with this request will be invalidated if `c1.cpd` selects the `foo` HTTP request parameter only, and the cache blocks are stored under the same cache policy, `c1.cpd`. However, the cache objects will *not* be invalidated if they were not stored under `c1.cpd`, or if `c1.cpd` also selects the `p1` parameter.

- If `autoInvalidateLevel="cookie"`, then the only cache entries invalidated are those associated with the same page, same selected parameters and values, and same cookies.

Note: If the page URI includes a question mark, then the default `autoInvalidateLevel` is `param`. If there is no question mark, then the default is `page`.

Example: Use of Cache Invalidation Tag

This section provides a brief example of cache invalidation. For complete sample applications, including cache invalidation, refer to the OC4J demos.

Example: invalidateCache Tag

The following page adds an item to a list of items previously cached, then invalidates the cache. The list will presumably be re-cached later with the new item.

```
<%@ taglib uri="/WEB-INF/jwcache.tld" prefix="ojsp" %>
<title>added.jsp</title>
<jsp:useBean class="java.util.Hashtable" id="table" scope="application" />
<%
   String itemid=request.getParameter("itemid");
   String addItem=request.getParameter("addItem");
   Vector list=(Vector) table.get(itemid);
   if (list==null) {
     list=new Vector();
     table.put(itemid,list);
   }
   list.addElement(addItem);
%>
<b><%= addItem %></b> was added into category <b><%= itemid %></b>.<br>
<% String viewPage="listitem.jsp?itemid="+itemid; %>
<% long l1=(new java.util.Date()).getTime(); %>
<ojsp:invalidateCache page="<%= viewPage %>" autoInvalidateLevel="param"
  policy="/WEB-INF/test-policy.cpd"
    />
<% long l2=(new java.util.Date()).getTime(); %>
Existing cache entry has been invalidated. <br>
Invalidation took <%= l2-l1 %> milliseconds.
<br>
<jsp:include page="<%= viewPage %>" flush="true" />
<br>
<a href="seeitems.jsp" >Select items</a>
or
<a href="additem.html" >Add items</a>
<br>
```

Web Object Cache Servlet API Descriptions

From servlets, you can use `CachePolicy` methods to modify cache policy settings or to invalidate a cache block, and `ExpirationPolicy` methods to modify expiration settings. This requires creating a cache policy object and retrieving its expiration policy object attribute (which the JSP cache tag handlers do automatically).

This section discusses the following:

- Cache Policy Object Creation
- CachePolicy Methods
- Expiration Policy Object Retrieval
- ExpirationPolicy Methods
- CacheBlock Methods
- Sample Servlet Using the Web Object Cache API

The Web Object Cache classes are in the file `ojsputil.jar`, which is supplied with OC4J. Verify that this file is installed and in your classpath. Also, to use the Oracle9*i* Application Server Java Object Cache as the back-end repository, the file `cache.jar` must be installed and in your classpath. This file also comes with OC4J.

For more information about the classes, interfaces, and methods described in this section, see the Javadoc that is supplied with OC4J.

Cache Policy Object Creation

There are two approaches to creating a `CachePolicy` object:

- Use the static `lookupPolicy()` method of the `CacheClientUtil` class.
- Use one of the public `CachePolicy` constructors.

Note: Cache policy objects are not resource objects, such as database connections or cursors, so you can manipulate them without life-cycle or resource management concerns.

Using the lookupPolicy() Method

In most situations, the most convenient way to create a `CachePolicy` object is through the static `lookupPolicy()` method of the `CacheClientUtil` class, provided with OC4J, as in the following example:

```
CachePolicy cachePolicyObject = oracle.jsp.jwcache.CacheClientUtil.lookupPolicy
                            (servletConfig, request, "/WEB-INF/foo.cpd");
```

Input a servlet configuration object (a `javax.servlet.ServletConfig` instance), a request object (a `javax.servlet.http.HttpServletRequest` instance), and the URI path (relative to the application root) of an XML cache policy descriptor file.

Here is a simple example of a cache policy descriptor file:

```
<!--
test-policy.cpd
-->

<cachePolicy scope="application">
<expirationPolicy expirationType="TTL" TTL="25" timeInaDay="00:10:00"
writeThrough="true" />
</cachePolicy>
```

See "Cache Policy Descriptor" on page 7-58 for more information.

Using a CachePolicy Constructor

The `oracle.jsp.jwcache.CachePolicy` class has the following public constructors—a simple constructor requiring only a servlet configuration object, a "copy" constructor that copies another `CachePolicy` object, and a "copy" constructor with a given servlet configuration object:

```
public CachePolicy(javax.servlet.ServletConfig config)

public CachePolicy(CachePolicy cPolicy)

public CachePolicy(javax.servlet.ServletConfig config,
                   CachePolicy cPolicy)
```

CachePolicy Methods

Several utility methods are available in `CachePolicy` objects, as well as getter and setter methods for key attributes.

CachePolicy Method Signatures and Common Parameters

The following abbreviated code, for illustration purposes only, contains signatures for key methods available in `CachePolicy` objects.

See "Cache Policy Attributes" on page 7-12 for a discussion of relevant attributes.

```
class CachePolicy
{
   boolean isRecent(CacheBlock block);
   void putCache(Object data, HttpServletRequest req, SectionId sectionId);
   void putCache(Object data, HttpServletRequest req, String specifiedName);
   void putAutoCacheForOtherPath(Object data, HttpServletRequest req,
                       String otherPath, StringSectionid sectionId);
   void putAutoCacheForOtherPath(Object data, HttpServletRequest req,
        String otherPath, Cookie[] newCookies, StringSectionid sectionId);
   CacheBlock getCache(HttpServletRequest req, SectionId sectionId);
   CacheBlock getCache(HttpServletRequest req, String specifiedName);
   CacheBlock getAutoCacheForOtherPath(HttpServletRequest req,
                         String otherPath, StringSectionId sectionId);
   CacheBlock getAutoCacheForOtherPath(HttpServletRequest req,
        String otherPath, Cookie[] newCookies, StringSectionId sectionId);
   void invalidateCache(HttpServletRequest req, SectionId sectionId);
   void invalidateCache(HttpServletRequest req, String specifiedName);
   void invalidateCacheLike(HttpServletRequest req, String specifiedName);
   void invalidateCacheLike(HttpServletRequest req, int autoInvalidateLevel);
   void invalidateCacheLike(HttpServletRequest req, String specifiedName,
                           int autoInvalidateLevel);
   void invalidateCacheOtherPathLike(HttpServletRequest req, String otherPath);
   void invalidateCacheOtherPathLike(HttpServletRequest req, String otherPath,
                         Cookie[] newCookies, int autoInvalidateLevel);
   Date getCurrentTime();
}
```

These methods use several common parameters:

- `req`, a `javax.servlet.http.HttpServletRequest` instance

  This is the current HTTP request object.

- `newCookies`, a `javax.servlet.http.Cookie[]` array

  This is an array of new cookies. If you pass in new cookies, they are used in cache operations that use the `otherPath` parameter (such as the `putAutoCacheForOtherPath()` method), assuming the cache policy selects some cookies, and invalidation is at the cookie level. If you do not pass in new cookies, then cookies of the current HTTP request are used instead.

- `specifiedName`, a Java string

  For explicit cache-block naming, this is the name—either the desired cache block name if you are creating a new cache block, or the existing cache block name if you are retrieving an existing cache block.

- `sectionId`, an `oracle.jsp.jwcache.SectionId` instance, specifically `StringSectionId` or `NumberSectionId`)

  For implicit cache-block naming, this is a counter that is used in tracking cache blocks. In JSP pages, it is used, incremented, and maintained by JSP cache tag handlers. It is stored in the JSP `pageContext` object.

  `SectionId` is an interface that is implemented by two classes—`StringSectionId` and `NumberSectionId`. Where `StringSectionId` is specified in a method signature, you must use an instance of that class. Where `SectionId` is specified, you can use an instance of either class, but should typically use `StringSectionId`. The `NumberSectionId` class is primarily intended for use by JSP tag handlers.

  In a servlet, you must create a section ID instance manually. "Sample Servlet Using the Web Object Cache API" on page 7-49 demonstrates the use of a `StringSectionId` instance.

  Note: When you construct a `StringSectionId` instance, the string must begin with an alphabetic (not numeric) character.

- `otherPath`, a Java string

  This is the URI of another JSP page that has an associated cache block that you want to store, retrieve, or invalidate.

- `autoInvalidateLevel`, an integer

  For implicit cache-block naming, you can use this to specify a level of invalidation—`application`, `page`, `parameter`, or `cookie`. Use the

`CachePolicy` integer constant `AUTO_INVALIDATE_APP_LEVEL`, `AUTO_INVALIDATE_PAGE_LEVEL`, `AUTO_INVALIDATE_PARAM_LEVEL`, or `AUTO_INVALIDATE_COOKIE_LEVEL`.

CachePolicy Method Descriptions

The `CachePolicy` methods function as follows:

- `isRecent()`

  This method checks the timestamp of the specified cache block and determines whether it is recent enough, given the current time and the values of the cache policy `reusableTimeStamp` and `reusableDeltaTime` attributes.

- `putCache(...)`

  Use this method to place an object into the cache repository. The `data` parameter is any serializable Java object you want to cache that will not require any further modification or mutation. In JSP pages, the JSP `cache` tag handler calls `putCache()` to cache a `BodyContent` instance. The `cacheXMLObj` tag handler calls it to cache an XML DOM object. In a servlet or `useCacheObj` tag, the cache target object can be any Java serializable object.

  You must also provide an HTTP request object, along with a cache block name (for explicit naming) or a section ID (for implicit naming).

  Note: The `putCache()` method does nothing if the cache policy `ignoreCache` attribute is set to "`true`".

- `putAutoCacheForOtherPath(...)`

  Place the specified object into the cache repository according to a specified string-based section ID and a specified page path, optionally using specified cookies as well. You must also input an `HttpServletRequest` object. The cache policy must *not* use explicit naming (in other words, must not have `autoType=TYPE_USERSPECIFIED`).

- `getCache(...)`

  Use this method to retrieve a cached item from the repository, in the form of an `oracle.jsp.jwcache.CacheBlock` instance. You can specify the cache block name (for explicit naming) or the section ID (for implicit naming). You must also provide an HTTP request object.

Note: The `getCache()` method does nothing if the cache policy `ignoreCache` attribute is `true`.

- `getAutoCacheForOtherPath(...)`

  Retrieve a cached item from the repository according to a specified string-based section ID and a specified page path, optionally using specified cookies as well. You must also input an `HttpServletRequest` object. The cache policy must *not* use explicit naming (in other words, must not have `autoType=TYPE_USERSPECIFIED`)—otherwise, an exception is thrown.

- `invalidateCache(...)`

  Use this method to invalidate a single cache block. Invalidation is according to the HTTP request object and also according to the specified cache block name (for explicit naming) or section ID (for implicit naming).

- `invalidateCacheLike(...)`

  Use this method to invalidate multiple cache blocks. If you use explicit cache-block naming and the cache repository supports wild-card naming, you can input the `specifiedName` parameter with "*" wild card characters. (The Oracle9*i* Application Server Java Object Cache currently does *not* support wild card characters.)

  If you use implicit cache-block naming, you must specify the `autoInvalidateLevel` parameter to determine, in combination with the `HttpServletRequest` object and optionally the `specifiedName` parameter, what cache blocks are invalidated. The `autoInvalidateLevel` parameter has the same functionality as in a JSP `invalidateCache` tag, as explained in "Web Object Cache invalidateCache Tag" on page 7-33 (using information from the request object, instead of using information from the `page` parameter of the `invalidateCache` tag).

- `invalidateCacheOtherPathLike(...)`

  Use this method to invalidate cache blocks associated with the URI you provide in the `otherPath` parameter. In the signature taking only a request object and the URI, the `autoInvalidateLevel` parameter is set automatically according to the URI—to `param` level if there is a question mark ("?") in the URI; to `page` level otherwise.

The detailed signature of this method enables you to specifically control the `autoInvalidateLevel` setting and the cookies used in invalidation.

- `getCurrentTime()`

  Retrieve the current time value, as a `java.util.Date` instance, of the underlying cache repository specified in this cache policy.

CachePolicy Getter and Setter Methods

You can use the following methods to retrieve or alter `CachePolicy` object attributes. See "Cache Policy Attributes" on page 7-12 for a discussion of these attributes.

- `boolean getIgnoreCache()`
- `void setIgnoreCache(boolean ignoreCache)`
- `void setIgnoreCache(String ignoreCacheStr)`
- `int getScope()`
- `void setScope(int scope)`

  For `scope` values, the integer constants `SCOPE_APP` and `SCOPE_SESSION` are available.

- `int getAutoType()`
- `void setAutoType(int autoType)`

  For `autoType` values, the integer constants `TYPE_USERSPECIFIED`, `TYPE_URI_ONLY`, `TYPE_URI_QUERYSTR`, `TYPE_URI_ALLPARAM`, `TYPE_URI_SELECTEDPARAM`, and `TYPE_URI_EXCLUDEDPARAM` are available.

- `String[] getSelectedParam()`
- `void setSelectedParam(String[] selectedParameters)`
- `void setSelectedParam(String selectedParamStr)`
- `String[] getSelectedCookies()`
- `void setSelectedCookies(String[] selectedCookies)`
- `void setSelectedCookies(String selectedCookiesStr)`
- `Date getReusableTimeStamp()`
- `void setReusableTimeStamp(Date reusableTimeStamp)`

- `void setReusableTimeStamp(long reusableTimeStamp)`

  For `reusableTimeStamp` values, the integer constant `REUSABLE_ALWAYS` is available, indicating that the cache is always reusable.

- `long getReusableDeltaTime()`
- `void setReusableDeltaTime(long reusableDeltaTime)`

  For `reusableDeltaTime` values, the integer constant `REUSABLE_ALWAYS` is available, indicating that the cache is always reusable.

- `ExpirationPolicy getExpirationPolicy()`
- `void setExpirationPolicy(ExpirationPolicy expirationPolicy)`
- `String getCacheRepositoryName()`
- `void setCacheRepositoryName(String repoName)`
- `boolean getReportException()`
- `void setReportException (boolean reportException)`
- `void setReportException (String reportExceptionStr)`

The following methods are also available, but are primarily intended for use by the Web Object Cache tag handlers:

- `void setScope(String scopeStr)`

  For `scope` values, the string constants `SCOPE_APP_STR` and `SCOPE_SESSION_STR` are available.

- `void setAutoType(String autoTypeStr)`
- `void setReusableTimeStamp(String reusableTimeStampStr)`

  For `reusableTimeStamp` values, the string constant `REUSABLE_IGNORED` is available, indicating that the cache is always reusable.

- `void setReusableDeltaTime(String reusableDeltaTimeStr)`

  For `reusableDeltaTime` values, the string constant `REUSABLE_IGNORED` is available, indicating that the cache is always reusable.

Expiration Policy Object Retrieval

Each `CachePolicy` object has an `ExpirationPolicy` attribute. If you want to set expiration policies for a cache block, you can use the `getExpirationPolicy()` method of its `CachePolicy` object, as in the following example:

```
CachePolicy cachePolicyObj = CacheClientUtil.lookupPolicy
                             (config, request, "/WEB-INF/mypolicy.cpd");
ExpirationPolicy expPolicyObj = cachePolicyObj.getExpirationPolicy();
```

ExpirationPolicy Methods

The `ExpirationPolicy` class has getter and setter methods for its attributes, as follows. For descriptions of these attributes, see "Expiration Policy Attributes" on page 7-18.

- `int getExpirationType()`
- `void setExpirationType(int expirationType)`
- `void setExpirationType(String expirationTypeStr)`
- `long getTTL()`
- `void setTTL(long ttl)`
- `long getTimeInaDay()`
- `void setTimeInaDay(long timeInaDay)`
- `void setTimeInaDay(String timeInaDayStr)`
- `int getDayInaWeek()`
- `void setDayInaWeek(int dayInaWeek)`
- `void setDayInaWeek(String dayInaWeekStr)`
- `int getDayInaMonth()`
- `void setDayInaMonth(int dayInaMonth)`
- `boolean getWriteThrough()`
- `void setWriteThrough(boolean writeThrough)`
- `void setWriteThrough(String writeThroughStr)`

Additionally, the `ExpirationPolicy` class has the following utility method:

- `long getExpirationTime(long createTime)`

  Given the creation time of a cache block expressed in milliseconds since midnight January 1, 1970, this method calculates and returns the expiration time, also in milliseconds since midnight January 1, 1970. That is, the timestamp when expiration should occur, according to the expiration policy.

The `ExpirationPolicy` class also defines the following integer constants for the `expirationType` attribute:

- `TYPE_TTL`
- `TYPE_DAILY`
- `TYPE_WEEKLY`
- `TYPE_MONTHLY`

And the following integer constants are defined for the `dayInaWeek` attribute:

- `WEEKLY_SUNDAY`
- `WEEKLY_MONDAY`
- `WEEKLY_TUESDAY`
- `WEEKLY_WEDNESDAY`
- `WEEKLY_THURSDAY`
- `WEEKLY_FRIDAY`
- `WEEKLY_SATURDAY`

CacheBlock Methods

You can use the `getCache()` method of a `CachePolicy` object to retrieve the associated `CacheBlock` object, as documented in "CachePolicy Methods" on page 7-41 and shown in the following section, "Sample Servlet Using the Web Object Cache API".

The abbreviated code that follows, for illustrative purposes only, shows the key methods of the `oracle.jsp.jwcache.CacheBlock` class.

```
class CacheBlock
{
   long getCreationTime();
   long getExpirationTime();
   Serializable getData();
}
```

Here are brief descriptions of these methods:

- `getCreationTime()`—Returns the timestamp indicating when the cache block was created.
- `getExpirationTime()`—Returns the timestamp indicating the expiration time of the cache block.
- `getData()`—Returns the cache block data.

Note: Creation time and expiration time are expressed in milliseconds since midnight, January 1, 1970.

Sample Servlet Using the Web Object Cache API

The following sample servlet, `DemoCacheServlet`, uses the Web Object Cache. The code is followed by notes about some of its operations.

```
package demoPkg;

import javax.servlet.*;
import javax.servlet.http.*;
import java.io.IOException;

import java.io.PrintWriter;
import java.io.CharArrayWriter;

import oracle.jsp.jwcache.CachePolicy;
import oracle.jsp.jwcache.ExpirationPolicy;
import oracle.jsp.jwcache.StringSectionId;
import oracle.jsp.jwcache.CacheBlock;
import oracle.jsp.jwcache.CacheClientUtil;

public class DemoCacheServlet extends HttpServlet{

  public void service(HttpServletRequest request, HttpServletResponse response)
    throws ServletException, IOException
```

```
{
  // standard writer object from servlet engine
  PrintWriter out=response.getWriter();
  ServletConfig config=getServletConfig();

  try {
    CachePolicy cachePolicyObj = CacheClientUtil.lookupPolicy(config,request,
      "/WEB-INF/test-policy.cpd" );  // Note A
    StringSectionId sectionId=new StringSectionId("s1");   // Note B
    CacheBlock cacheBlockObj=null;

    cacheBlockObj = cachePolicyObj.getCache(request,sectionId); // Note C
    if (!cachePolicyObj.isRecent(cacheBlockObj)) {  // Note D
      CharArrayWriter newOut=new CharArrayWriter();
      PrintWriter pw=new PrintWriter(newOut);

      // actual logic within a cache block
      pw.println("fragment#1");
      pw.println(new java.util.Date());
      // which generates content into the "out" object

      if (cacheBlockObj == null) {   // Note E
        cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
        // Note F
      }

      out.write(newOut.toCharArray());
      // writing out newly created data back to the original writer
    }
    else {
      out.write((char[])cacheBlockObj.getData());
      // writing the existing cached data to the writer
    }

    sectionId=new StringSectionId("s2");
    long timeToLive = 15;   // now set TTL to 15 on this block
    ExpirationPolicy expirationPolicy = cachePolicyObj.getExpirationPolicy();
    expirationPolicy.setTTL(timeToLive);
    cachePolicyObj.setExpirationPolicy(expirationPolicy);
    cacheBlockObj = cachePolicyObj.getCache(request,sectionId);
    if (!cachePolicyObj.isRecent(cacheBlockObj)) {
      CharArrayWriter newOut=new CharArrayWriter();
      PrintWriter pw=new PrintWriter(newOut);

      // actual logic within a cache block
```

```
        pw.println("fragment#2");
        pw.println(new java.util.Date());
        // which generates content into the "out" object

        if (cacheBlockObj == null) {
          cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
        }

        out.write(newOut.toCharArray());
        // writing out newly created data back to the original writer
      }
      else {
        out.write((char[])cacheBlockObj.getData());
        // writing the existing cached data to the writer
      }

    } catch (Throwable th) {
      // your exception handling code here
      th.printStackTrace(out);
    }
  }
}
```

Code Notes The following notes describe some of the key functionality of the preceding example:

- The cache policy object is created in the `lookupPolicy()` call (Note A), with attribute settings according to the cache policy descriptor `test-policy.cpd`.
- The section ID is created for each cache block (Note B), as required for implicit cache-block naming. See "CachePolicy Methods" on page 7-41 for information about section IDs.
- The cache block is retrieved from the repository through the `getCache()` method of the cache policy object (Note C), and placed into the repository through the `putCache()` method, according to the section ID in each case.
- The `isRecent()` call determines if the cache block is recent enough to use (Note D). If so, the cached data is retrieved through the `getData()` method of the cache block. (See "CacheBlock Methods" on page 7-48.) If not, a special `PrintWriter` object is created to buffer the output and save it back to the cache repository. If the cache block object is not found (is null, Note E), then the `putCache()` method of the cache policy object is called to create a new cache block (Note F).

Tag Code Versus API Code

This example presents code for three approaches to an application that caches and presents timestamp output from two cache fragments:

- The first approach, `tagcode.jsp`, is a simple JSP page that uses the Oracle Web Object Cache tags.
- The second approach, `servletcode.jsp`, is a more involved JSP page that uses the Web Object Cache servlet API (instead of the cache tags) inside a Java scriptlet.
- The third approach, `DemoCacheServlet.java`, uses the Web Object Cache servlet API inside a servlet.

Following the three code samples is a listing of the cache policy descriptor, `test-policy.cpd`.

In each approach, the application will cache the two fragments it displays. You can reload repeatedly, but the times displayed in the fragments will not change until the cached fragments expire. The first fragment takes 25 seconds to expire, getting the 25-second time-to-live value from the `TTL` setting in the cache policy descriptor (`test-policy.cpd`). The second fragment takes 15 seconds to expire, overriding the cache policy descriptor time-to-live value with a value set directly in the page code.

Output for the sample applications looks something like the following:

```
fragment#1  (expires in 25 seconds as per TTL value test-policy)
Sun May 27 15:20:46 PDT 2001

fragment#2 (expires in 15 seconds because TTL overrides test-policy value)
Sun May 27 15:20:46 PDT 2001
```

Simple JSP Page: tagcode.jsp

```
<%@ taglib uri="/WEB-INF/jwcache.tld" prefix="ojsp" %>
<title>tagcode.jsp</title>
<pre>
tagcode.jsp
<ojsp:cache policy="/WEB-INF/test-policy.cpd" >
  fragment#1  (expires in 25 seconds as per TTL value test-policy)
  <%= new java.util.Date() %>
</ojsp:cache>
<ojsp:cache policy="/WEB-INF/test-policy.cpd" TTL="15" >
  fragment#2 (expires in 15 seconds because TTL overrides test-policy value)
```

```
  <%= new java.util.Date() %>
</ojsp:cache>
</pre>
```

Scriptlet JSP Page: servletcode.jsp

Code notes are the same as for the servlet version below, which is repeated and described in "Sample Servlet Using the Web Object Cache API" on page 7-49.

```
<%@ page import="oracle.jsp.jwcache.*,java.io.*" %>
<title>servletcode.jsp</title>
<pre>
servletcode.jsp
<%
  CachePolicy cachePolicyObj = CacheClientUtil.lookupPolicy(config,request,
   "/WEB-INF/test-policy.cpd" );  // Note A
  StringSectionId sectionId=new StringSectionId("s1");   // Note B
  CacheBlock cacheBlockObj=null;

  cacheBlockObj = cachePolicyObj.getCache(request,sectionId); // Note C
  if (!cachePolicyObj.isRecent(cacheBlockObj)) {  // Note D
    CharArrayWriter newOut=new CharArrayWriter();
    PrintWriter pw=new PrintWriter(newOut);

    // actual logic within a cache block
    pw.println
("fragment#1 (expires in 25 seconds as per TTL value test-policy)");
    pw.println(new java.util.Date());
    // which generates content into the "out" object

    if (cacheBlockObj == null) {   // Note E
      cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
      // Note F
    }

    out.write(newOut.toCharArray());
    // writing out newly created data back to the original writer
  }
  else {
    out.write((char[])cacheBlockObj.getData());
    // writing the existing cached data to the writer
  }

  sectionId=new StringSectionId("s2");
```

```
  long timeToLive = 15;   // now set TTL to 15 on this block
  ExpirationPolicy expirationPolicy = cachePolicyObj.getExpirationPolicy();
  expirationPolicy.setTTL(timeToLive);
  cachePolicyObj.setExpirationPolicy(expirationPolicy);
  cacheBlockObj = cachePolicyObj.getCache(request,sectionId);
  if (!cachePolicyObj.isRecent(cacheBlockObj)) {
    CharArrayWriter newOut=new CharArrayWriter();
    PrintWriter pw=new PrintWriter(newOut);

    // actual logic within a cache block
    pw.println
("fragment#2 (expires in 15 seconds because TTL overrides test-policy value)");
    pw.println(new java.util.Date());
    // which generates content into the "out" object

    if (cacheBlockObj == null) {
      cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
    }

    out.write(newOut.toCharArray());
    // writing out newly created data back to the original writer
  }
  else {
    out.write((char[])cacheBlockObj.getData());
    // writing the existing cached data to the writer
  }

%>
</pre>
```

Servlet Page: DemoCacheServlet.java

This sample also appears in "Sample Servlet Using the Web Object Cache API" on page 7-49. Refer there for information about the code notes.

```
package demoPkg;

import javax.servlet.*;
import javax.servlet.http.*;
import java.io.IOException;

import java.io.PrintWriter;
import java.io.CharArrayWriter;
```

```
import oracle.jsp.jwcache.CachePolicy;
import oracle.jsp.jwcache.ExpirationPolicy;
import oracle.jsp.jwcache.StringSectionId;
import oracle.jsp.jwcache.CacheBlock;
import oracle.jsp.jwcache.CacheClientUtil;

public class DemoCacheServlet extends HttpServlet{

  public void service(HttpServletRequest request, HttpServletResponse response)
    throws ServletException, IOException
  {
    // standard writer object from servlet engine
    PrintWriter out=response.getWriter();
    ServletConfig config=getServletConfig();

    try {
      CachePolicy cachePolicyObj = CacheClientUtil.lookupPolicy(config,request,
        "/WEB-INF/test-policy.cpd" );  // Note A
      StringSectionId sectionId=new StringSectionId("s1");   // Note B
      CacheBlock cacheBlockObj=null;

      cacheBlockObj = cachePolicyObj.getCache(request,sectionId); // Note C
      if (!cachePolicyObj.isRecent(cacheBlockObj)) {  // Note D
        CharArrayWriter newOut=new CharArrayWriter();
        PrintWriter pw=new PrintWriter(newOut);

        // actual logic within a cache block
        pw.println("fragment#1");
        pw.println(new java.util.Date());
        // which generates content into the "out" object

        if (cacheBlockObj == null) {   // Note E
          cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
          // Note F
        }

        out.write(newOut.toCharArray());
        // writing out newly created data back to the original writer
      }
      else {
        out.write((char[])cacheBlockObj.getData());
        // writing the existing cached data to the writer
      }

      sectionId=new StringSectionId("s2");
```

```
        long timeToLive = 15;   // now set TTL to 15 on this block
        ExpirationPolicy expirationPolicy = cachePolicyObj.getExpirationPolicy();
        expirationPolicy.setTTL(timeToLive);
        cachePolicyObj.setExpirationPolicy(expirationPolicy);
        cacheBlockObj = cachePolicyObj.getCache(request,sectionId);
        if (!cachePolicyObj.isRecent(cacheBlockObj)) {
          CharArrayWriter newOut=new CharArrayWriter();
          PrintWriter pw=new PrintWriter(newOut);

          // actual logic within a cache block
          pw.println("fragment#2");
          pw.println(new java.util.Date());
          // which generates content into the "out" object

          if (cacheBlockObj == null) {
            cachePolicyObj.putCache(newOut.toCharArray(),request,sectionId);
          }

          out.write(newOut.toCharArray());
          // writing out newly created data back to the original writer
        }
        else {
          out.write((char[])cacheBlockObj.getData());
          // writing the existing cached data to the writer
        }

      } catch (Throwable th) {
        // your exception handling code here
        th.printStackTrace(out);
      }
    }
  }
```

Cache Policy Descriptor: test-policy.cpd

This cache policy descriptor is used by all three approaches to the sample application—`tagcode.jsp`, `servletcode.jsp`, and `DemoCacheServlet.java`:

```
<!--
test-policy.cpd
-->

<cachePolicy scope="application">
<expirationPolicy expirationType="TTL" TTL="25" timeInaDay="00:10:00"
writeThrough="true" />
</cachePolicy>
```

Cache Policy Descriptor

You can optionally use an XML-style cache policy descriptor to specify attribute settings for the `CachePolicy` and `ExpirationPolicy` objects. In any JSP pages or servlets that you use, you would then specify the cache policy descriptor through the `policy` attribute of a `cache`, `cacheXMLObj`, `useCacheObj`, `cacheInclude`, or `invalidateCache` tag.

This section provides the cache policy descriptor DTD, a sample cache policy descriptor, and information about loading and refreshing the cache policy descriptor.

Cache Policy Descriptor DTD

This section provides a listing of the Web Object Cache cache policy descriptor DTD, `cachepolicy.dtd`. For an example of a cache policy descriptor, see "Sample Cache Policy Descriptor" on page 7-59.

```
<!--
cachepolicy.dtd
-->
<!--
This DTD is used to validate any (Oracle programmable web)
cache policy descriptors (e.g. "/WEB-INF/foo.cpd").
-->

<!--
The cachePolicy element is the root element of cache policy descriptors.
configuration descriptor.
-->

<!ELEMENT cachePolicy (
   selectedParam*, selectedCookie*,
   reusableTimeStamp?, reusableDeltaTime?,
   cacheRepositoryName?, expirationPolicy? ) >

<!ATTLIST cachePolicy ignoreCache (true | false) "false" >
<!ATTLIST cachePolicy scope (application | session) "application" >
<!ATTLIST cachePolicy autoType
   (user | URI | URI_query |
    URI_allParam | URI_selectedParam | URI_excludedParam )
    "URI_allParam" >
<!ATTLIST cachePolicy reportException (true | false) "true" >
```

```
<!ELEMENT selectedParam (#PCDATA) >
<!ELEMENT selectedCookie (#PCDATA) >
<!ELEMENT reusableTimeStamp (#PCDATA) >
<!ELEMENT reusableDeltaTime (#PCDATA) >
<!ELEMENT cacheRepositoryName (#PCDATA) >

<!ELEMENT expirationPolicy EMPTY >

<!ATTLIST expirationPolicy expirationType (TTL | daily | weekly | monthly)
         "TTL" >
<!ATTLIST expirationPolicy TTL CDATA "300" >
<!ATTLIST expirationPolicy timeInaDay CDATA #IMPLIED >
<!ATTLIST expirationPolicy dayInaWeek
   (Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday)
   "Wednesday" >
<!ATTLIST expirationPolicy dayInaMonth CDATA "10" >
<!ATTLIST expirationPolicy writeThrough (true | false) "true" >
```

Sample Cache Policy Descriptor

This section provides an example of a simple cache policy descriptor that sets the `TTL` and `timeInaDay` attributes. For the DTD, see the preceding section, "Cache Policy Descriptor DTD".

```
<!--
test-policy.cpd
-->

<cachePolicy scope="application">
<expirationPolicy expirationType="TTL" TTL="25" timeInaDay="00:10:00"
writeThrough="true" />
</cachePolicy>
```

Cache Policy Descriptor Loading and Refreshing

To create a `CachePolicy` object from an XML cache policy descriptor file, there must be a call to the static `lookupPolicy()` method of the `oracle.jsp.jwcache.CacheClientUtil` class. For JSP pages, this is handled automatically. For servlets, you must include the `lookupPolicy()` call in your code—see "Sample Servlet Using the Web Object Cache API" on page 7-49.

If the caching policy has not been previously loaded, then the `lookupPolicy()` method results in the XML descriptor being parsed and used in constructing a new `CachePolicy` object (and an `ExpirationPolicy` attribute of this object). See "Cache Policy Object Creation" on page 7-39 for information about the `lookupPolicy()` method.

The `CachePolicy` object is stored indirectly under the `ServletContext` object associated with your application. When the same caching policy is requested again, the stored policy object will be returned without the descriptor being reread or re-parsed. For performance reasons, because the cache policy descriptor files are seldom changed, as well as for security reasons, OC4J does not provide descriptor auto-reloading functionality. The resulting cache policy object is stored in the middle-tier JVM for faster access.

The `CachePolicy` object will be valid until the servlet context is destroyed or someone calls the static `refreshPolicy()` method of the `CacheClientUtil` class. This method has the same calling sequence as the `lookupPolicy()` method. For example:

```
oracle.jsp.jwcache.CacheClientUtil.refreshPolicy
                  (servletConfig, request, "/WEB-INF/foo.cpd");
```

When you alter and refresh the caching policy, active cache blocks are not affected.

Cache Repository Descriptor

Use an XML-style cache repository descriptor to specify what to use as the back-end cache repository for the Web Object Cache, and how to configure it. This section supplies the DTD for cache repository descriptors, as well as a sample cache repository descriptor.

Note: By default, the Web Object Cache uses the Oracle9*i* Application Server Java Object Cache as its cache repository.

Cache Repository Descriptor DTD

This section provides a listing of the Web Object Cache cache repository descriptor DTD, `wcache.dtd`. For an example of a cache repository descriptor, see the next section, "Sample Cache Repository Descriptor".

```
<!--
Copyright 2000 Oracle Corporation
wcache.dtd
-->
<!--
This DTD is used to validate "/WEB-INF/wcache.xml", which is used to hold
web cache repositories configuration information for
Oracle programmable web caching components.
-->

<!--
The wcache-config element is the root element of web cache repositories
configuration descriptor.
-->

<!ELEMENT wcache-config (cache-repository*)>

<!ELEMENT cache-repository
(cache-repository-name,cache-repository-class,init-param*)>

<!ELEMENT cache-repository-name (#PCDATA)>
<!ELEMENT cache-repository-class (#PCDATA)>

<!ELEMENT init-param (param-name,param-value)>
<!ELEMENT param-name (#PCDATA)>
<!ELEMENT param-value (#PCDATA)>
```

Sample Cache Repository Descriptor

This section lists the cache repository descriptor provided with OC4J. For the DTD, see the preceding section, "Cache Repository Descriptor DTD".

> **Note:** The DTD does not include `reporoot`, which is a specific-use parameter that only a file system cache implementation requires.

```
<wcache-config>

<cache-repository>
   <cache-repository-name>DefaultCacheRepository</cache-repository-name>
   <cache-repository-class>
      oracle.jsp.jwcache.repository.impl.OCSRepoImpl
   </cache-repository-class>
</cache-repository>

<cache-repository>
   <cache-repository-name>SimpleFSRepo</cache-repository-name>
   <cache-repository-class>
      oracle.jsp.jwcache.repository.impl.SimpleFSRepositoryImpl
   </cache-repository-class>
   <init-param>
      <param-name>reporoot</param-name>
      <param-value>/tmp/reporoot</param-value>
   </init-param>
</cache-repository>

</wcache-config>
```

Configuration for Back-End Repository

This section describes how to configure the Oracle9*i* Application Server Java Object Cache or a file system as the back-end repository for the OC4J Web Object Cache.

Configuration Notes for Oracle9*i* Application Server Java Object Cache

The following preparatory steps are required in order to use the default cache repository, Oracle9*i* Application Server Java Object Cache, in an OC4J environment:

1. Update `global-web-application.xml` to add an initialization parameter to specify the location of the Java Object Cache configuration file, `OCS4J.properties`.

   For example, for a UNIX system:

```
<servlet>
   <servlet-name>jsp</servlet-name>
   <servlet-class>oracle.jsp.runtimev2.JspServlet</servlet-class>
   <init-param>
      <param-name>ocs4j_file</param-name>
      <param-value>
         <your_install_root>/demo/ojspdemos/ojspdemos-web/WEB-INF/misc-file/OCS4J.properties
      </param-value>
   </init-param>
</servlet>
```

   Notes:

   - The Java Object Cache `cache.jar` file must be available in the *<your_install_root>*`/lib` directory.
   - The `misc-file` directory is created automatically when you extract the demo programs.

2. Update `OCS4J.properties` as appropriate. To set a root directory for the Java Object Cache, update the `diskPath` entry.

   For a UNIX system, do this as in the following example:

```
diskPath = /mydir/ocs4jdir
```

For a Windows NT system, do this as follows (note that you have to specify a drive letter):

```
diskPath = c:\mydir\ocs4jdir
```

3. Restart the Web server.

Configuration Notes for File System Cache

To use a file system as the back-end repository, edit the cache repository descriptor (`wcache.xml`) to set `reporoot` to specify a root directory for the file system cache. This file is located in the `WEB-INF` directory where the OC4J samples are installed. See "Cache Repository Descriptor" on page 7-61 for general information and for an example of a cache repository descriptor that sets a `reporoot` value.

For example, for a UNIX system:

```
<init-param>
   <param-name>reporoot</param-name>
   <param-value>/mydir/repositoryroot</param-value>
</init-param>
```

or for a Windows NT system:

```
<init-param>
   <param-name>reporoot</param-name>
   <param-value>c:\mydir\repositoryroot</param-value>
</init-param>
```

8

JSP Utilities and Utility Tags

This chapter documents a variety of general utility features available with OC4J for use in JSP pages, including the following:

- JSP Event-Handling with JspScopeListener
- Mail JavaBean and Tag
- File-Access JavaBeans and Tags
- EJB Tags
- General Utility Tags

JSP Event-Handling with JspScopeListener

In standard servlet and JSP technology, only session-based events are supported. Oracle extends this support to page-based, request-based, and application-based events through the `JspScopeListener` interface and `JspScopeEvent` class in the `oracle.jsp.event` package.

This section covers the following topics:

General Use of JspScopeListener

For Java objects in your application, implement the `JspScopeListener` interface in the appropriate class, then attach objects of that class to a JSP scope using tags such as `jsp:useBean`.

When the end of a scope is reached, objects that implement `JspScopeListener` and have been attached to the scope will be notified. The JSP container accomplishes this by sending a `JspScopeEvent` instance to such objects through the `outOfScope()` method specified in the `JspScopeListener` interface.

Properties of the `JspScopeEvent` object include the following:

- the scope that is ending (represented by one of the constants `PAGE_SCOPE`, `REQUEST_SCOPE`, `SESSION_SCOPE`, or `APPLICATION_SCOPE`)
- the container object that is the repository for objects at this scope (one of the implicit objects `page`, `request`, `session`, or `application`)
- the name of the object to which the notification pertains (the name of the instance of the class that implements `JspScopeListener`)
- the JSP implicit `application` object

This event listener mechanism significantly benefits developers who want to always free object resources that are of `page` or `request` scope, regardless of error conditions. It frees these developers from having to surround their page implementations with Java `try`/`catch`/`finally` blocks.

For a complete sample, refer to the OC4J demos.

Use of JspScopeListener in OC4J and Other Servlet 2.3 Environments

`JspScopeListener` uses different mechanisms to support the different scopes, though all are implemented according to servlet and JSP standards.

For pages running in an OC4J environment, there is also an OC4J-specific runtime implementation for `page` scope, for convenience.

This section covers the following topics:

- Requirements for JspScopeListener
- Runtime and Tag Implementations to Support Page Scope
- Servlet Filter Implementation to Support Request Scope
- Listener Class Implementation to Support Application Scope
- Integration with HttpSessionBindingListener to Support Session Scope

Requirements for JspScopeListener

The `JspScopeListener` implementation requires the following:

- the `oracle.jsp.event.JspScopeListener` interface and `JspScopeEvent` class, and the classes of the `oracle.jsp.event.impl` package, all of which are supplied in the `ojsp.jar` file
- a servlet 2.3 environment (such as OC4J)

Runtime and Tag Implementations to Support Page Scope

For OC4J and JServ environments, there is support for `page` scope functionality through an Oracle-specific runtime implementation. For OC4J, enable this by setting the JSP `check_page_scope` configuration parameter to `true` (the default is `false`, for performance reasons). For JServ, `page` scope checking is always enabled and `check_page_scope` has no effect.

For portability to other environments, there is also an implementation to support `page` scope through a special tag, `checkPageScope`. Put the appropriate code between the `checkPageScope` start-tag and end-tag. This tag, with no attributes, is defined as follows:

```
<!-- The checkPageScope tag -->
<tag>
   <name>checkPageScope</name>
   <tagclass>oracle.jsp.jml.tagext.CheckPageScopeListenerTag</tagclass>
   <bodycontent>JSP</bodycontent>
```

```
   <info>
      To provide the notification logic for any
      JspScopeListener stored in page scope.
      This tag is not needed on
      JServ or OC4J.
   </info>
</tag>
```

Here is an example of its use:

```
<%@ taglib uri="/WEB-INF/jml.tld" prefix="jml" %>
<jml:checkPageScope>
pagescope.jsp
<jsp:useBean id="tb" class="testpkg.TestData" />
<%
   /* testpkg.TestData implements oracle.jsp.event.JspScopeListener.
      checkPageScope tag will provide the notification logic for any
      JspScopeListener stored in page scope.
      This tag is not needed on JServ
      or OC4J.
   */
   // some more JSP / code here ...
%>
<%= new java.util.Date() %>
</jml:checkPageScope>
```

Note: The `checkPageScope` tag is currently part of the Oracle JML tag library, which is included in the `ojsputil.jar` file and requires the `jml.tld` tag library descriptor file. An appropriate `taglib` directive is shown in the preceding example (the "jml" prefix is typical). See "Overview of the JSP Markup Language (JML) Tag Library" on page 3-2 for related information.

Servlet Filter Implementation to Support Request Scope

Objects of `request` scope are supported through a servlet filter. The filtering applies to any servlets matching a specified URL pattern.

For support of event-handling for request-scope objects, add an entry such as the following to the `web.xml` file for your application (or to `orion-web.xml` or `global-web-application.xml`, as appropriate). To ensure proper operation of the `JspScopeListener` functionality, this setting must be *after* any other `filter` settings.

```
<filter>
   <filter-name>Request Filter</filter-name>
   <filter-class>oracle.jsp.event.impl.RequestScopeFilter</filter-class>
</filter>
<!-- Define filter mappings for the defined filters -->
<filter-mapping>
   <filter-name>Request Filter</filter-name>
   <url-pattern>/jsp/*</url-pattern>
</filter-mapping>
```

Note: In this particular example, "`/jsp/*`" is the URL pattern covered by the filter. Users may choose other patterns instead, such as "`/*.jsp`" or "`/*`".

Listener Class Implementation to Support Application Scope

Objects with `application` scope are supported through a servlet context listener implementation class, in accordance with the servlet 2.3 specification. For support of event-handling for application-scope objects, add an entry such as the following to the `web.xml` file for your application. To ensure proper operation of the `JspScopeListener` functionality, this setting must be *after* any other `listener` settings.

```
<listener>
   <listener-class>oracle.jsp.event.impl.AppScopeListener</listener-class>
</listener>
```

For an application-scope object, in addition to notification upon the conclusion of the application and servlet context, there is notification when an attribute is replaced in the servlet context or removed from the servlet context. For example, the listener `outOfScope()` method of an application-scope object is called in either of the following circumstances, assuming a servlet context object `ctx`:

```
ctx.setAttribute("name", "Smith");
...
ctx.setAttribute("name, "Jones");
```

or:

```
ctx.setAttribute("name", "Smith");
...
ctx.removeAttribute("name");
```

Note: This functionality was not available prior to Oracle9*i*AS release 2.

Integration with HttpSessionBindingListener to Support Session Scope

For session-scope objects, you can write a class that implements both the `JspScopeListener` interface and the standard `javax.servlet.http.HttpSessionBindingListener` interface. This would give you the flexibility of supporting instances of this class for other scopes as well. If instances would never be used outside of `session` scope, however, there is no need to implement `JspScopeListener`.

In the integration scenario, the `valueUnbound()` method, specified in the `HttpSessionBindingListener` interface, should call the `outOfScope()` method, specified in the `JspScopeListener` interface.

Following is a basic example:

```
import oracle.jsp.event.impl.*;
import javax.servlet.*;
import javax.servlet.http.*;

class SampleObj implements HttpSessionBindingListener,JspScopeListener
{
   public void valueBound(HttpSessionBindingEvent e)
   {
      System.out.println("The object implements the JspScopeListener also");
   }

   public void valueUnBound(HttpSessionBindingEvent e)
   {
      try
      {
         outOfScope(new JspScopeEvent(null,(Object)e.getSession(),
             e.getName(),javax.servlet.jsp.PageContext.SESSION_SCOPE));
      } catch (Throwable e) {}
   ...........
   }
   public void outOfScope(JspScopeEvent e)
   {...}
}
```

Examples Using JspScopeListener

This section provides two examples of `JspScopeListener` usage—first a JSP page and accompanying JavaBean, and then a servlet.

Example: JSP Page Using JspScopeListener

This example consists of a JavaBean, `ScopeDispatcher`, that implements the `JspScopeListener` interface, and a JSP page that uses `ScopeDispatcher` instances for request-scope and application-scope functionality.

bookcatalog.jsp The `bookcatalog.jsp` page allows users to search for a book in the catalog or insert a new book entry. The catalog is kept in a hashtable that is initially read from the local file stream.

At the end of a request, if a new book has been submitted it is entered into the application-level `catalog` hashtable, and the book count is incremented.

At the end of execution of the application, the `catalog` hashtable is sent back to the local file stream, the number of newly inserted books is shown, and query results are displayed if there was a book search.

```
<%@ page import="java.util.*" %>
<%@ page import="java.io.*" %>
<%! static int newbookCount = 0; %>
<%! static Hashtable catalog; %>
<%! boolean bookAdded = false; %>
<html>
<head>
<title> BookStore Price catalog </title>
</head>
<body bgcolor="white">
<font size=5 color="red">
<table color="#FFFFCC" width="100%" border="1" cellspacing="0" cellpadding="0" >
<tr>
<td>
<form action="bookcatalog.jsp">
<b> BookName </b>
<input type="text" name="bookname">
<input type="submit" value="Get the Price">
</form>
</td>
<td>
<form action="bookcatalog.jsp">
<b>BookName</b>
```

```
<input type="text" name="new_book">
<br>
<b>Price</b>
<input type="text" name="price">
<input type="submit" value="Add to Catalog">
</form>
</td>
</tr>
</table>

<%
  String bookname = request.getParameter("bookname");
  catalog = (Hashtable) application.getAttribute("pricelist");
  if (catalog == null)
  {
   try{
    ObjectInputStream oin = new ObjectInputStream
                           (new FileInputStream("bookcatalog.out"));
    Object obj =  oin.readObject();
    catalog = (Hashtable) obj;
    oin.close();
   }
  catch(Exception e) {
   catalog = new Hashtable();}
  application.setAttribute("pricelist",catalog);
 }
  if (bookname != null)
  {
    String price = (String) catalog.get(bookname.trim());
    if (price != null)
    {
     out.println("<h2>Book : " +bookname+ "</h2>");
     out.println("<h2>Price: "+price +"</h2>");
    }
    else
      out.println("<h2> Sorry, the  Book : " + bookname + " is not available in
                    the catalog</h2>");
  }
%>

<%-- declare the event dispatchers --%>
<jsp:useBean id = "requestDispatcher"
             class = "oracle.jsp.sample.event.ScopeDispatcher"
             scope = "request" >
```

```
   <jsp:setProperty name = "requestDispatcher" property = "page"
                    value = "<%= this %>" />
   <jsp:setProperty name = "requestDispatcher" property = "methodName"
                    value = "request_OnEnd" />
</jsp:useBean>

<jsp:useBean id = "appDispatcher"
             class = "oracle.jsp.sample.event.ScopeDispatcher"
             scope = "application" >
   <jsp:setProperty name = "appDispatcher" property = "page"
                    value = "<%= this %>" />
   <jsp:setProperty name = "appDispatcher" property = "methodName"
                    value = "application_OnEnd" />
</jsp:useBean>
<%!
   // request_OnEnd Event Handler
   public void request_OnEnd(HttpServletRequest request) {
      // acquire beans
               String newbook  = request.getParameter("new_book");
               bookAdded = false;
               if ((newbook != null) && (!newbook.equals("")))
               {
                  catalog.put(newbook,request.getParameter("price"));
                  newbookCount++;
                  bookAdded = true;
               }
   }
%>

<%!
  public void application_OnEnd(ServletContext application)
  {
    try
    {
      ObjectOutputStream os = new ObjectOutputStream(
                                  new FileOutputStream("bookcatalog.out"));
      os.writeObject(catalog);
      os.flush();
      os.close();
    }
    catch (Exception e)
    {}
  }
%>
```

```
<%
if (bookAdded)
   out.println("<h2> The New book is been added in the catalog </h2>");
%>
<%-- Page implementation goes here --%>
<h2> Total number of books added is <%= newbookCount %></h2>
</font>
</body>
</html>
```

ScopeDispatcher.java

```
package oracle.jsp.sample.event;
import java.lang.reflect.*;
import oracle.jsp.event.*;

public class ScopeDispatcher extends Object implements JspScopeListener {
    private Object page;
    private String methodName;
    private Method method;

    public ScopeDispatcher() {
    }

    public Object getPage() {
        return page;
    }

    public void setPage(Object page) {
        this.page = page;
    }

    public String getMethodName() {
        return methodName;
    }

    public void setMethodName(String m) throws NoSuchMethodException,
                                               ClassNotFoundException  {
        method = verifyMethod(m);
        methodName = m;
    }

    public void outOfScope(JspScopeEvent ae) {
        int scope = ae.getScope();
```

```
        if ((scope == javax.servlet.jsp.PageContext.REQUEST_SCOPE  ||
             scope == javax.servlet.jsp.PageContext.APPLICATION_SCOPE)
             && method != null) {
            try {
                Object args[] = {ae.getContainer()};
                method.invoke(page, args);
            } catch (Exception e) {
                // catch all and continue
            }
        }
    }

    private Method verifyMethod(String m) throws NoSuchMethodException,
                                                 ClassNotFoundException {
        if (page == null) throw new NoSuchMethodException(
                                  "A page hasn't been set yet.");

        // Don't know whether this is a request or page handler so try one then
       // the other
        Class c = page.getClass();
        Class pTypes[] = {Class.forName("javax.servlet.ServletContext")};

        try {
            return c.getDeclaredMethod(m, pTypes);
        } catch (NoSuchMethodException nsme) {
            // fall through and try the request signature
        }

        pTypes[0] = Class.forName("javax.servlet.http.HttpServletRequest");
        return c.getDeclaredMethod(m, pTypes);
    }
}
```

Example: Servlet Using JspScopeListener

This section contains a sample servlet that uses `JspScopeListener` functionality for a request-scope object. The nested class `DBScopeObj` implements the `JspScopeListener` interface.

```
import java.io.IOException;
import java.io.PrintWriter;
import java.util.Enumeration;
import javax.servlet.*;
```

```
import javax.servlet.http.*;
import oracle.jsp.event.*;
import oracle.jsp.event.impl.*;

public class RequestScopeServlet extends HttpServlet {

    PrintWriter out;

    public void doGet(HttpServletRequest request, HttpServletResponse response)
        throws ServletException, IOException
    {
        out         = response.getWriter();
        out.println("<html>");
        out.println("<body>");
        out.println("<head>");
        out.println("<title> RequestScopeServlet! </title>");
        out.println("</head>");
        response.setContentType("text/html");
        DBScopeObj aobj = new DBScopeObj();
        request.setAttribute("dbcon",aobj);
        request.setAttribute("name","scott");
        request.setAttribute("company","oracle");
        request.setAttribute("city","sanmateo");
        Enumeration en = request.getAttributeNames();
        out.println("<BR> Request Attributes : <BR> <BR>");
        while (en.hasMoreElements()) {
            String key = (String)en.nextElement();
            Object value = request.getAttribute(key);
            out.println(key + "   : " + value+"<BR>");
         }
        out.println("</body>");
        out.println("</html>");
    }

    class DBScopeObj implements JspScopeListener
    {
       public void initDBConnection()
       {
            //  can create a minimum number of predefined
            // DBConnections
       }
```

```
        DBScopeObj()
        {
            // if DBconnection is available in the connection
            // pool then pickup from the pool and give the handle.
        }

        public void outOfScope(JspScopeEvent e)
        {
         ServletContext ctx = e.getApplication();
         out.println
             ("<BR>*************************************************");
         out.println("<BR> JspScopeEvent <BR>");
         out.println("<BLINK>");
         out.println
             ("<BR> In outOfScope method for the Request Attribute <BR>");
         out.println("Name =  " +e.getName() + "<BR>");
         out.println("</BLINK>");
         out.println
             ("*************************************************<BR>");
         // logging in the context also

         ctx.log("*************************************************");
         ctx.log(" JspScopeEvent ");
         ctx.log(" In outOfScope method for the Request Attribute ");
         ctx.log("Name =  " +e.getName());
         ctx.log("*************************************************");
         returnDBConnection();
        }

        public void returnDBConnection()

        {
            //Can return the handle to the connection pool
        }
    }
}
```

Mail JavaBean and Tag

It is often useful to send e-mail messages from a Web application, based on Web site status or user actions, for example. Sun Microsystems has specified a platform-independent and protocol-independent framework for this through its `javax.mail` package and subpackages, known as the JavaMail API.

For further convenience, Oracle supplies a JavaBean and JSP custom tag, based on the JavaMail API, to use in providing e-mail functionality through your servlets or JSP pages. The bean and tag, as with other JavaBeans and custom tags supplied with OC4J, are implemented according to JSP and servlet standards.

This section, organized as follows, describes the mail JavaBean and tag:

Note: In Oracle9*i*AS, the mail JavaBean and tag require the OC4J environment; JServ is not supported.

For more information about the JavaMail API, refer to the following Sun Microsystems Web site:

`http://java.sun.com/products/javamail/1.2/docs/javadocs/index.html`

General Considerations for the Mail JavaBean and Tag

Be aware of the following points, which apply to use of either the mail JavaBean (`SendMailBean`) or the mail tag (`sendMail`):

- The files `mail.jar`, containing the JavaMail packages, and `jaf.jar`, for the JavaBeans Activation Framework, must be in your classpath for mail functionality. These files are provided with OC4J.
- To enable support for attachments, the file `sendmail.properties` must exist, with an appropriate setting, in the application `/WEB-INF` directory. (In the OC4J demo instance it exists there by default, but with a setting that disables attachments.) See "Enabling Attachments" on page 8-15.

- There is no particular limit to the size of an e-mail message, other than limits of the JVM, system memory, or mail server.
- Setting up default mail sessions is specific to the particular Web server. The Oracle9*i*AS release 2 implementations of the mail bean and tag do not support automatic use of the default mail session. As an alternative, you can write your own code to obtain the default mail session if one exists for your platform, and make the session available to the mail bean or tag.

Mail Attachments

With Oracle9*i*AS release 2 (9.0.3), the mail bean and tag support the sending of attachments with e-mail messages. There are three modes of operation:

- no support for attachments
- support for attaching one or more files that are on the OC4J server machine, known as *server-side attachments*
- support for attaching one file that is on the client machine, known as a *client-side attachment*

For a client-side attachment, the file is automatically uploaded to the server machine as part of the process. Multiple client-side attachments are not supported.

Enabling Attachments

By default, for security reasons, the mail attachment feature is disabled for both the mail tag and mail bean. Whether attachments are enabled, and which kind of attachments, are determined by a `sendmail.properties` file in the application `/WEB-INF` directory. For the OC4J demo instance, this file exists by default with the following content:

```
## email attachment permissions
sendmail.attachment=none
```

You must copy this file to `/WEB-INF`, or create it from scratch, and update it appropriately for any other OC4J instance that will use mail attachments.

Any single application can support server-side attachments or client-side attachments, but not both.

To enable server-side attachments, change the setting to `server`, as follows:

```
sendmail.attachment=server
```

To enable client-side attachments, change the setting to `client`, as follows:

```
sendmail.attachment=client
```

Having multiple settings is an error condition.

> **Note:** The absence of a `sendmail.properties` file is treated the same as the presence of `sendmail.properties` with a setting of `none`—mail attachments are disabled.

Sending Attachments

For the mail tag, if server-side attachments are enabled, use the `serverAttachment` tag attribute if you want to specify one or more server-side files to attach to a message. If client-side attachments are enabled, use the `clientAttachment` tag attribute if you want to specify a client-side file to attach to a message (maximum of one file). See "The sendMail Tag Description" on page 8-22. Note that either one of the two attachment modes, but not both, can be supported for any single application.

For both the server attachment mode and the client attachment mode, the mail bean includes methods to specify or retrieve the name (or names) of the file (or files) to attach. See information about `setServerAttachment()`, `getServerAttachment()`, `setClientAttachment()`, and `getClientAttachment()` in "SendMailBean Method Descriptions" on page 8-18.

With either the mail tag or mail bean, a list of server-side files to attach can be either comma-delimited or semicolon-delimited, but not space-delimited (given that spaces are allowed in file names in some operating systems).

Attachment Usage Notes

Be aware of the following usage notes for mail attachments, applying to both the mail tag and mail bean.

- For a client-side file attachment, the file-access `httpUpload` tag is used behind the scenes—the file is uploaded to a temporary location on the OC4J server machine, then deleted once the message has been sent. Any limitations of the `httpUpload` tag apply to a client-side mail attachment as well. See "File-Access JavaBeans and Tags" on page 8-29.
- Many e-mail servers have somewhat restrictive size limitations, often approximately 4 MB for any one attachment. The only restrictions for the mail tag or bean are according to disk or memory limitations of the server machine.

- If a problem is encountered with any attachment, the e-mail message is aborted.
- Path names are not exposed to the mail recipient in either the server attachment or client attachment mode. Only the file name itself is indicated.
- For server-side attachments, attaching multiple files of the same name (but obviously with different paths) is supported. How this is handled at the recipient end, regarding any possible file renaming to avoid conflict, is according to the mail client being used. Similarly, in either attachment mode, the mail client might rename a file if an attachment has the same name as an attachment to a previous message. This is all beyond the scope and control of the OC4J mail attachment feature.
- You cannot use wild-card characters for file names.

SendMailBean Description

The `oracle.jsp.webutil.email.SendMailBean` JavaBean is supplied with OC4J to support e-mail functionality from servlet or JSP applications. To use it in a JSP page, you can instantiate it through the standard `jsp:useBean` tag. (For JSP applications, however, you would typically use the `sendMail` tag instead of `SendMailBean`—see "The sendMail Tag Description" on page 8-22.)

SendMailBean Requirements

To use `SendMailBean`, verify that the files `ojsputil.jar`, `mail.jar`, and `activation.jar` are installed and in your classpath. These files are supplied with OC4J.

When you use `SendMailBean` in your code, you must provide the following:

- the message sender

  Use the `setSender()` method to specify the sender.

- the primary recipient (or recipients) of the message

  Use the `setRecipient()` method to specify the primary recipient (or recipients).

- a valid JavaMail session object (`javax.mail.Session`), either directly or indirectly

  There are three ways to supply a JavaMail session:

  – Use the `setHost()` method to specify a host system. In this case, a JavaMail session object will be created automatically.

- Use the `setMailSession()` method to provide a JavaMail session object directly.
- For JSP applications, use the `setSession()` method to specify the name of a JavaMail session object that already exists and is accessible through a "session string, `javax.mail.Session` object" pair in the JSP page context. In this case, you must supply the page context instance as an input parameter when you call the `sendMessage()` method to send the e-mail message.

All other `SendMailBean` attributes are optional.

SendMailBean Method Descriptions

This section lists and describes `SendMailBean` methods to send mail messages, close mail sessions, and set or get bean attributes.

> **Note:** To comply with the JavaBean specification, `SendMailBean` has a no-argument constructor.

Here are the public `SendMailBean` methods:

- `void sendMessage()`
- `void sendMessage(javax.servlet.jsp.PageContext)`

  Use the `sendMessage()` method to send the e-mail message.

  If you use the `setSession()` method to supply a JavaMail session, then you must use the `sendMessage(PageContext)` signature and provide the page context instance that holds the specified mail session instance.

  If you use the `setMailSession()` or `setHost()` method to supply a JavaMail session, then you do *not* have to provide a page context in using the `sendMessage()` method.

  Also be aware, however, that specifying a page context instance may be relevant in determining the character set of an e-mail message with a "text" content type. If you provide no page context when invoking the `sendMessage()` method, then the default character set is `ISO-8859-1`. If you *do* provide a page context, then the default character set is that of the `response` object of the page context. Also note that you can specify the content type and character set directly through the `setContentType()` method.

- `void close()`

  Use this method if you want to release the resources of the JavaMail session instance from the `SendMailBean` instance. This method does not actually close the session.

- `void setBcc(String s)`

  Specify a space-delimited or comma-delimited list of any IDs (e-mail addresses or aliases) to receive "blind" copies of the message. These IDs will be suppressed from the message Cc field.

- `String getBcc()`

  Retrieve the list of IDs to receive "blind" copies of the message.

- `void setCc(String s)`

  Specify a space-delimited or comma-delimited list of any IDs (e-mail addresses or aliases) to receive copies of the message. These IDs will appear in the message Cc field.

- `String getCc()`

  Retrieve the list of IDs to receive copies of the message.

- `void setContent(String s)`

  Specify the contents of the e-mail message.

- `String getContent()`

  Retrieve the contents of the e-mail message.

- `void setContentEncoding(String s)`

  Specify the content encoding of the e-mail message. Specify "`base64`" or "`B`" for base64 encoding, "`quoted-printable`" or "`Q`" for quoted-printable encoding, "`7bit`" for seven-bit encoding, or "`8bit`" for eight-bit encoding. These content encodings are part of the JavaMail and RFC 2047 standards. Entries are case-insensitive.

  The default content encoding setting is "`null`", in which case the encoding of the message and headers will be determined by the content. If most characters to be encoded are in ASCII, then quoted-printable encoding will be used; otherwise, `base64` encoding will be used.

- `String getContentEncoding()`

  Retrieve the content encoding of the message.

- `void setContentType(String s)`

  Specify the MIME type and optionally the character set of the message, such as in the following examples:

  ```
  setContentType("text/html");

  setContentType("text/html; charset=US-ASCII");
  ```

  The default MIME type setting is "`text/plain`", but you cannot specify a character set without explicitly specifying that or some other "`text/`*`xxxx`*" MIME type setting.

  The default character set depends on whether you provide a JSP page context instance when you call the `sendMessage()` method to send the e-mail message. If you provide no page context, then the default character set is `ISO-8859-1`. If you do provide a page context, then the default character set is that of the `response` object of the page context.

- `String getContentType()`

  Retrieve the MIME type (and character encoding, if applicable) of the message.

- `void setHost(String s)`

  One of the ways to supply a JavaMail session is to specify a mail server host name, in which case `SendMailBean` will obtain a session automatically. Use the `setHost()` method for this purpose, providing a mail host name such as "`gmail.oraclecorp.com`".

  See "SendMailBean Requirements" on page 8-17 for an overview of supplying the JavaMail session.

- `String getHost()`

  Retrieve the specified mail server host name.

- `void setMailSession(javax.mail.Session sessobj)`

  One of the ways to supply a JavaMail session is to provide the session object directly. Use the `setMailSession()` method for this purpose, providing a `javax.mail.Session` instance.

  See "SendMailBean Requirements" on page 8-17 for an overview of supplying the JavaMail session.

- `javax.mail.Session getMailSession()`

  This returns a JavaMail session that you had previously set.

- `void setRecipient(String s)`

  Specify a space-delimited or comma-delimited list of IDs (e-mail addresses or aliases) of the primary recipients of the message. These IDs will appear in the To field of the message. You must specify at least one recipient.

- `String getRecipient()`

  Retrieve the list of IDs of the primary recipients of the message.

- `void setSender(String s)`

  Specify the ID (e-mail address or alias) of the message sender. This ID will appear in the From field of the message. You must specify the sender.

- `String getSender()`

  Retrieve the ID of the message sender.

- `void setSession(String s)`

  One of the ways to supply a JavaMail session is to provide the name of a `javax.mail.Session` instance that already exists in the JSP page context object. Use the `setSession()` method for this purpose, specifying the name of the session instance.

  In this case, when you use the `sendMessage()` method to send the e-mail message, you must provide the `javax.servlet.jsp.PageContext` instance as input.

  See "SendMailBean Requirements" on page 8-17 for an overview of supplying the JavaMail session.

- `String getSession()`

  Retrieve the name of the session instance.

- `void setSubject(String s)`

  Specify the subject line of the message.

- `String getSubject()`

  Retrieve the subject line of the message.

- `void setServerAttachment(String s)`

  Specify a comma-delimited or semicolon-delimited list of file names (including paths), for server-side files to attach to an e-mail message. These must be files on the OC4J server machine. Server-side attachments must be enabled in the `sendmail.properties` file.

- `String getServerAttachment()`

  Retrieve the file name list for server-side files to attach to the message. This might be useful in presenting a user confirmation page, for example.

- `void setClientAttachment(String s)`

  Specify the path and file name of the client-side file to attach to the e-mail message (maximum of one). This must be a file on the user's client machine. Client-side attachments must be enabled in the `sendmail.properties` file.

- `String getClientAttachment()`

  Retrieve the name of the client-side file to attach to the message. This might be useful in presenting a user confirmation page, for example.

Note: Regarding mail attachments, see "Mail Attachments" on page 8-15 for related information.

The sendMail Tag Description

As a convenience for JSP developers, OC4J supplies the `sendMail` tag to provide e-mail functionality for a JSP page. This section describes the tag, including the following topics:

- The sendMail Tag Syntax
- The sendMail Tag Attribute Descriptions
- Sample Application for sendMail Tag

To use the `sendMail` tag, verify that the files `ojsputil.jar`, `mail.jar`, and `activation.jar` are installed and in your classpath. These files are supplied with OC4J.

In the current implementation, the `sendMail` tag has its own TLD file, `email.tld`. This file must be deployed with the application, and any JSP page using the tag must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

The sendMail Tag Syntax

The `sendMail` tag has the following syntax:

```
<mail:sendMail host = "SMTP_host_name" | session = "JavaMail_session_name"
               sender = "sender_address"
               recipient = "primary_recipient_IDs"
             [ cc = "cc_recipient_IDs" ]
             [ bcc = "bcc_recipient_IDs" ]
             [ subject = "subject_line" ]
             [ contentType = "MIME_type; [charset=charset]" ]
             [ contentEncoding = "B"|"base64"|"Q"|"quoted-printable"|
                                 "7bit"|"8bit" ]
             [ serverAttachment = "server_file_list" |
               clientAttachment = "client_file" ] >
...
E-mail body
...
</mail:sendMail>
```

sendMail Tag Usage Notes Be aware of the following when using the `sendMail` tag:

- The `sender` and `recipient` attributes are required, and either the `host` or `session` attribute is required.
- Multiple recipients, "cc" targets, or "bcc" targets are space-delimited or comma-delimited.
- Use of `serverAttachment` assumes server-side attachments are enabled in the `sendmail.properties` file. Similarly, use of `clientAttachment` assumes client-side attachments are enabled in `sendmail.properties`. Only one mode can be enabled for a single application. See "Enabling Attachments" on page 8-15.
- File names in the `serverAttachment` setting can be comma-delimited or semicolon-delimited, but not space-delimited.
- The e-mail body can contain JSP syntax, which will be processed by the JSP translator.
- Attributes used by the tag are typically input by the user in form fields. All attributes accept request-time expressions.
- The prefix "mail:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.

- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

The sendMail Tag Attribute Descriptions

The `sendMail` tag supports the following attributes:

- `host` (required if `session` is not specified)—This is the appropriate mail host name, such as "`gmail.oraclecorp.com`". This is used in creating a JavaMail session object for the mail message. Alternatively, you can determine a JavaMail session through the `session` attribute.
- `session` (required if `host` is not specified)—This is the name of an existing JavaMail session object that can be retrieved from the JSP page context. Alternatively, you can determine a JavaMail session through the `host` attribute.
- `sender` (required)—This is the ID (e-mail address or alias) of the sender of the message. This ID will appear in the From field of the message.
- `recipient` (required)—This is a space-delimited or comma-delimited list of IDs of the primary recipients of the message. These IDs will appear in the To field of the message.
- `cc` — This is a space-delimited or comma-delimited list of IDs to receive a copy of the message. These IDs will appear in the Cc field of the message.
- `bcc` —This is a space-delimited or comma-delimited list of IDs to receive a "blind" copy of the message. These IDs will be suppressed from the Cc field.
- `subject`—This is the subject line of the message.
- `contentType`—This is for the MIME type of the message, and optionally a character set as well, as in the following examples:

  ```
  contentType="text/html"

  contentType="text/html; charset=US-ASCII"
  ```

  The default MIME type setting is "`text/plain`", but you cannot specify a character set without explicitly specifying that or some other `text/`*`xxxx`* MIME type.

  The default character set is that of the `response` object of the JSP page context.
- `contentEncoding`—Specify "`B`" or "`base64`" for base64 encoding, "`Q`" or "`quoted-printable`" for quoted-printable encoding, "`7bit`" for seven-bit

encoding, or "8bit" for eight-bit encoding. These are standard JavaMail and RFC 2047 encodings. Entries are case-insensitive.

The default content encoding setting is "null", in which case the encoding of the message and headers will be determined by the content—if most characters to be encoded are in ASCII, then quoted-printable encoding will be used; otherwise, base64 encoding will be used.

- serverAttachment—This is a comma-delimited or semicolon-delimited list of server-side files to attach to the e-mail message. Server-side attachments must be enabled in the sendmail.properties file. (Either server-side or client-side attachments can be enabled, but not both.)

  Here is an example:

  ```
  serverAttachment="/tmp/confirm.pdf,/home/schedule.doc"
  ```

- clientAttachment—This is the name of a client-side file (maximum of one) to attach to the e-mail message. Client-side attachments must be enabled in the sendmail.properties file. (Either server-side or client-side attachments can be enabled, but not both.)

  Here is an example:

  ```
  clientAttachment="c:\finance\budget02.xls"
  ```

Note: Regarding e-mail attachments, see "Mail Attachments" on page 8-15 for related information.

Sample Application for sendMail Tag

This sample application illustrates use of the sendMail tag, with no attachments. During the first execution cycle through the page, before the user has specified the sender (or anything else), the HTML form is displayed for user input. During the next execution cycle through the page, after the user has sent the input, the sendMail tag is executed. This page also uses an error page, error.jsp (shown below), to display any exceptions that are thrown.

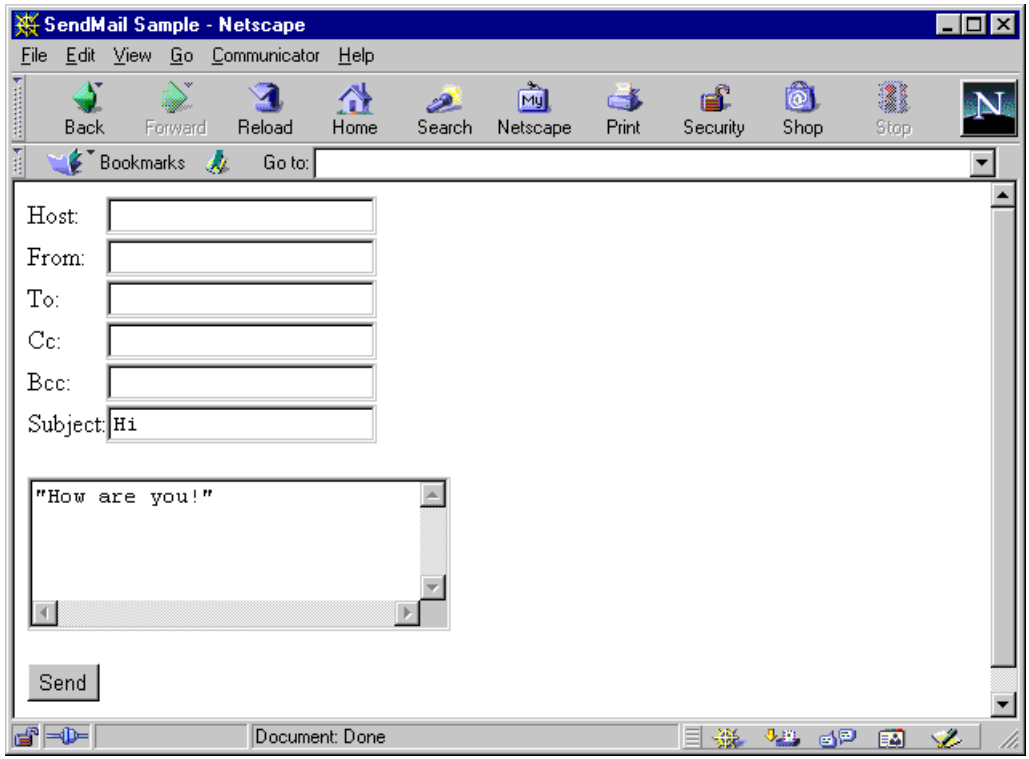
```
<%@ page language="java" errorPage="error.jsp" %>
<%@ taglib uri="/WEB-INF/email.tld" prefix="mail" %>
<%
if (request.getParameter("sender")==null) {
%>
<HTML>
```

```
<HEAD><TITLE>SendMail Sample</TITLE></HEAD>
<FORM METHOD=post>
<TABLE BORDER=0 CELLSPACING=0 CELLPADDING=0 WIDTH="20%">
<TR><TD>Host:</TD><TD><INPUT TYPE="text" name="host" ></TD></TR>
<TR><TD>From:</TD><TD><INPUT TYPE="text" name="sender" ></TD></TR>
<TR><TD>To:</TD><TD><INPUT TYPE="text" name="recipient"  ></TD></TR>
<TR><TD>Cc:</TD><TD><INPUT TYPE="text" name="cc" ></TD></TR>
<TR><TD>Bcc:</TD><TD><INPUT TYPE="text" name="bcc" ></TD></TR>
<TR><TD>Subject:</TD><TD><INPUT TYPE="text" name="subject"
VALUE="Hi"></TD></TR>
</TABLE><br>
<TEXTAREA name="body" ROWS=4 COLS=30>"How are you!"</TEXTAREA><br><br>
<INPUT TYPE="submit" value="Send">
</FORM>
<%
}
else{
%>
<BODY BGCOLOR="#FFFFFF">
<P>Result:
       <HR>
       <mail:sendMail host='<%=request.getParameter("host")%>'
             sender='<%=request.getParameter("sender")%>'
             recipient='<%=request.getParameter("recipient")%>'
             cc='<%=request.getParameter("cc")%>'
             bcc='<%=request.getParameter("bcc")%>'
             subject='<%=request.getParameter("subject")%>'>
             <%=request.getParameter("body")%>
       </mail:sendMail>
Sent out Successfully!
       <HR>
</BODY>
<%
}
%>
</HTML>
```

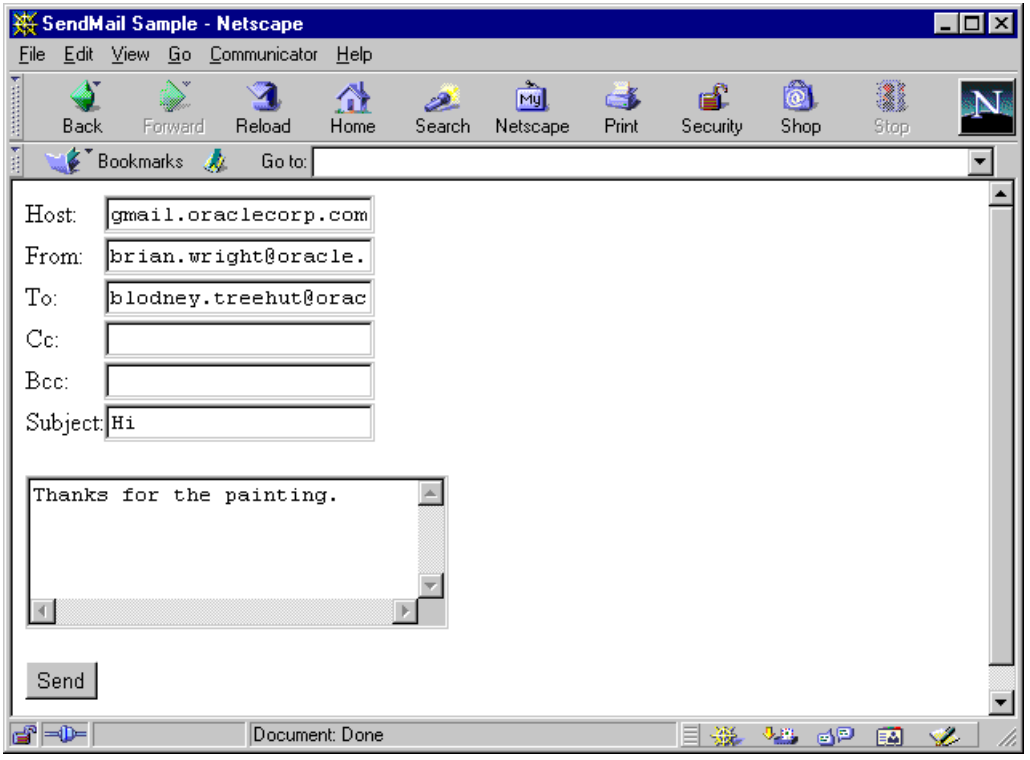
Here is the error page, `error.jsp`:

```
<%@ page language="java" isErrorPage="true"%>
<HTML>
Error: <%= exception.getMessage() %>
</HTML>
```

When you run this application, you will initially see the following default screen:



And here is sample user input for a message from `brian.wright@oracle.com` to `blodney.treehut@oracle.com` through the host `gmail.oraclecorp.com`:



File-Access JavaBeans and Tags

OC4J provides a standards-compliant tag library and JavaBeans that add convenient file upload and file download functionality for JSP pages and servlets. Files can be uploaded to or downloaded from a file system or database.

This section documents these features and is organized as follows:

- Overview of OC4J File-Access Functionality
- File Upload and Download Tag Descriptions
- File Upload and Download JavaBean and Class Descriptions

Note: In Oracle9*i*AS, the file-access JavaBeans and tags require the OC4J environment; JServ is not supported.

Overview of OC4J File-Access Functionality

Developers have the option of using either custom tags or JavaBeans to program applications that allow users to upload or download files. In either case, the application is presumably programmed so that users specify through the browser where files come from on the client system for uploading, or where they go to on the client system for downloading. For JSP pages for uploading, OC4J supplies a convenience tag, `httpUploadForm`, to create a form for this purpose.

For processing an upload, including specifying the destination file system or database location, use the `HttpUploadBean` JavaBean or the `httpUpload` tag. For processing a download, including specifying the source file system or database location, use `HttpDownloadBean` or the `httpDownload` tag. The beans extend `HttpFileAccessBean`, which is not intended for public use. All of the beans are in the `oracle.jsp.webutil.fileaccess` package.

Overview of File Uploading

For user specification in a JSP page of where uploaded files will come from, you can use the `httpUploadForm` tag to create a form. This tag lets users select the files for uploading, and creates the necessary multipart HTTP request. You also have the option of using a standard HTML form to create the request.

Use the `HttpUploadBean` JavaBean or the `httpUpload` tag to receive and process the multipart form-encoded data stream and write the files to the appropriate location, either in the file system or a database. There is functionality to let you

decide whether previous data will be overwritten if the target file or database row already exists.

Note: The maximum file size for any upload is 2 GB.

File System Destination If the destination is in a file system, you must provide a properties file that designates a base directory. The properties file must be named `fileaccess.properties`, must be located in the `/WEB-INF` directory of your application, and must have a `fileaccess.basedir` entry such as the following (this example is for a Microsoft Windows system):

```
fileaccess.basedir=C:\tmp
```

Under the base directory, there should be subdirectories as appropriate—for example, a subdirectory for each authorized user. Destination subdirectories under the base directory must be specified through an attribute of the upload bean or tag. All directories and subdirectories must already exist and be writable; they cannot be created or made writable through OC4J functionality.

Database Destination If the destination is in a database, you can optionally use a default table, `fileaccess`, that you create through the supplied `fileaccess.sql` script, or you can use any other previously existing table containing the required column types. In either case, you must provide a connection to the database, as an instance of either `oracle.jsp.dbutil.ConnBean` or the standard `java.sql.Connection`. You can provide a `ConnBean` instance either explicitly, or, in a JSP page, implicitly as a result of nesting the `httpUpload` tag inside a `dbOpen` tag. (For information about the `ConnBean` JavaBean and `dbOpen` tag, see Chapter 4, "Data-Access JavaBeans and Tags".)

Note: As of Oracle9iAS release 2 (9.0.3), `java.sql.Connection` is supported for the file-access beans only, not the tags.

You are also required to specify a destination through an attribute of the upload bean or tag. The destination is simply a Java string value that will be placed in the *prefix* column of the database table. The prefix is equivalent to a file system path.

File data is written to a database as either a BLOB or a CLOB (specify which through an upload bean or tag attribute).

If you do not use the default `fileaccess` table, you must use attributes of the upload bean or tag to specify the database table name and the names of the columns that will contain the file data, the file prefix, and the file name. Any other table you use must adhere to the pattern of `fileaccess`, as follows:

- It must have a concatenated unique key consisting of the column that holds the file name and the column that holds the prefix.
- It must have a BLOB or CLOB column for the file data.
- Any column other than the file data column must allow null data.

Notes:

- When you use a `ConnBean` instance, the connection will be closed automatically at the end of the scope designated in the `jsp:useBean` tag that invokes it. There is no such functionality for a `Connection` instance.
- `ConnBean` uses and requires the `JspScopeListener` interface. See "JSP Event-Handling with JspScopeListener" on page 8-2 for information about that utility.

Security Considerations for Uploading For uploading to a database, the database table does not have a column to indicate a particular authorized user for any given file. Therefore, without precaution, each user can see files that were uploaded by other users, without having to know the file prefixes. To prevent this, you can prepend an appropriate user name to each prefix.

Overview of File Downloading

Use the `HttpDownloadBean` JavaBean or the `httpDownload` tag as follows:

- to allow users to specify the file system source directory or the database prefix to match for file retrieval

  Note the following:

  - Matching the prefix for downloads from a database is case-sensitive.
  - Matching the source directory for downloads from a file system is case-sensitive in case-sensitive operating systems (such as UNIX).
  - There is currently no support for specifying file names, either partial or complete.

- to obtain and display a list of the files that are available for download

  Once presented with a list of available files, the user can download them one at a time from the list.

There is also functionality to specify whether you want *recursive* downloading, where files in subdirectories or with additional database prefix information will also be available for download. For database downloading, a prefix is equivalent to a file system path and can be used to group files into a hierarchy. As an example of recursive downloading from a database, assume you have specified `/user` as the prefix. Recursive downloading would find matches for files with any prefixes starting with "`/user`", such as "`/user/bill`" and "`/user/mary`", and also such as "`/user1`", "`/user2`", "`/user1/tom`", and "`/user2/susan`".

For downloading files from a file system, use the mechanism described in "Overview of File Uploading" on page 8-29—use the `fileaccess.properties` file to specify a base directory, and use attributes in the download bean or tag to specify the rest of the file path.

For downloading files from a database, as with uploading files to a database, you must provide an instance of `oracle.jsp.dbutil.ConnBean` or `java.sql.Connection`. In addition, if you are not using the default `fileaccess` table (that you can create using the supplied `fileaccess.sql` script), you must provide all the necessary information about the database table and columns. Specify this information through attributes of the download bean or tag.

The actual downloading of the files is accomplished by `DownloadServlet`, supplied with OC4J. In using the download tag, specify the path of this servlet through a tag attribute. For a file system source, hyperlinks are automatically created to the servlet so that the user can select a link for each file in order to download the file. For a database source, the servlet will fetch the selected CLOB or BLOB data that forms the file contents. (See "The Download Servlet" on page 8-44.)

Security Considerations for Downloading For downloading, consider limiting the users' ability to see what is in the source (server-side) file system or database. Without precaution, the following scenarios are possible:

- For file system downloading, a source value of "`*`" (perhaps specified through user input) would mean that all directories under the base directory would be available for downloading, with the names of all the files presumably being displayed for the user to choose from.
- For recursive downloading from a database, all files having a prefix beginning with the `source` string (perhaps specified through user input) would be

available for downloading, with the names of all these files presumably being displayed. A source of "*" matches all prefixes.

If this is of concern, you can consider protective measures such as the following:

- not accepting `source` values of "*" when downloading from file systems
- not allowing recursive downloading from databases
- automatically prepending the `source` value with a partial directory path or prefix string, such as a user name, to restrict the areas to which users have access

File Upload and Download JavaBean and Class Descriptions

This section describes attributes and methods of the file upload and download JavaBeans provided with OC4J—`HttpUploadBean` and `HttpDownloadBean`, respectively.

There is also brief discussion of `DownloadServlet`, provided with OC4J to perform the actual file downloading, and the class `FileAccessException` that is used by the file-access JavaBeans for exceptions relating to file uploads and downloads.

To comply with the JavaBean specification, the file upload and download JavaBeans provide no-argument constructors.

Note: To use the file upload and download JavaBeans, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with OC4J.

The HttpUploadBean

The `oracle.jsp.webutil.fileaccess.HttpUploadBean` JavaBean provides numerous setter methods for specifying information used for the uploading. It also includes most corresponding getter methods. Once you have set all the required and appropriate attributes, use the `upload()` method to perform the upload. There is also a method to display the names of the files that were uploaded, typically so you can provide an informative message to the browser.

`HttpUploadBean`, as with `HttpDownloadBean`, extends `HttpFileAccessBean`, which itself is not intended for public use.

See "Overview of File Uploading" on page 8-29 for related information.

Summary of Required Attributes

The following list summarizes required attributes for `HttpUploadBean`:

- always required: `destination`
- also required for uploads to a database: `destinationType`, `connection`
- also required for uploads to a database table other than the default `fileaccess` table: `table`, `prefixColumn`, `fileNameColumn`, `dataColumn`
- also required for uploads to a database table using a CLOB column for file data: `fileType`

In addition, for an upload to a file system, you must call the `setBaseDir()` method to provide a servlet context and HTTP request object so that the bean can find the `fileaccess.properties` file that specifies the base directory.

Methods

Here are descriptions of the public methods of `HttpUploadBean`.

> **Note:** Many of the attributes and setter methods for `HttpUploadBean` are the same as for `HttpDownloadBean`.

- ```
  void upload(javax.servlet.http.HttpServletRequest req)
                                  throws FileAccessException
  ```

  Once all required and appropriate bean attributes have been set, use this method for the upload. The `req` parameter is the HTTP request instance containing the multipart form-encoded files. For a JSP page, use the implicit `request` object.

- ```
  void setBaseDir(javax.servlet.ServletContext sc,
                  javax.servlet.http.HttpServletRequest req)
                                  throws FileAccessException
  ```

  For an upload to a file system, use this method to determine what to use as a base directory. It gets this information from the `fileaccess.properties` file in your application `/WEB-INF` directory, which it finds through the servlet context input parameter. The `baseDir` setting, together with the `destination` setting, specifies the absolute path to the upload directory.

  The `req` parameter is the servlet request instance to use in requesting the base directory information. For JSP pages, use the implicit `request` object.

This method is not relevant for database uploads.

- `void setDestination(String destination)`

  This method is always required.

  For an upload to a file system, `destination`, together with the base directory, specifies the absolute path to the upload directory.

  For an upload to a database, `destination` is used as the file prefix. (There is no "base directory".) The prefix is equivalent to a file system path and can be used to group files into a hierarchy. It is permissible to include separator characters such as "`.`" and "`/`" in the destination string.

  Note: Typically, the `destination` value will be based at least partially on user input.

- `void setDestinationType(String destinationType)`
  `throws FileAccessException`
- `void setDestinationType(int destinationType)`
  `throws FileAccessException`

  Use the overloaded `setDestinationType()` method to specify whether the upload is to a file system or a database.

  To upload to a database, set `destinationType` to one of the following: the string "`database`", the defined `String` constant `FileAccessUtil.DATABASE`, the `int` value 1, or the defined `int` constant `FileAccessUtil.LOCATION_TYPE_DATABASE`.

  Uploading to a file system is the default, but if you want to specify this explicitly, set `destinationType` to one of the following: the string "`filesystem`", the defined `String` constant `FileAccessUtil.FILESYSTEM`, the `int` value 0, or the defined `int` constant `FileAccessUtil.LOCATION_TYPE_FILESYSTEM`.

  `FileAccessUtil` is in the `oracle.jsp.webutil.fileaccess` package.

- `String getDestinationType()`

  Retrieve the destination information. Note there is a getter method for the string version only.

- `void setOverwrite(String overwrite)`
  `throws FileAccessException`
- `void setOverwrite(boolean overwrite)`

  Use the overloaded `setOverwrite()` method to overwrite existing files or update rows with the same file name and prefix. This is relevant for both file system and database uploads.

  Overwriting is enabled by default, but you can enable it explicitly with an `overwrite` setting of the string "`true`" or the boolean value `true`. Disable overwriting with a setting of the string "`false`" or the boolean value `false`. String settings are case-insensitive. No settings are accepted other than those listed here.
- `void setFileType(String fileType)`
  `throws FileAccessException`
- `void setFileType(int fileType) throws FileAccessException`

  For an upload to a database, use the overloaded `setFileType()` method to specify whether the data is to be stored in a BLOB for binary data (the default) or a CLOB for character data. For a CLOB, set `fileType` to one of the following: the string "`character`", the defined `String` constant `FileAccessUtil.CHARACTER_FILE`, or the `int` value 1. To explicitly specify a BLOB, set `fileType` to one of the following: the string "`binary`", the defined `String` constant `FileAccessUtil.BINARY_FILE`, or the int value 0. String settings are case-insensitive. No settings are accepted other than those listed here.

  `FileAccessUtil` is in the `oracle.jsp.webutil.fileaccess` package.
- `String getFileType()`

  Retrieve the file type information. Note there is a getter method for the string version only.
- `void setTable(String tableName)`

  For an upload to a database table other than the default `fileaccess` table, use this method to specify the table name.
- `String getTable()`

  Retrieve the table name.

- `void setPrefixColumn(String prefixColumnName)`

  For an upload to a database table other than the default `fileaccess` table, use this method to specify the name of the column containing the file prefix. (In `fileaccess`, this column name is `fileprefix`.) The `destination` value will be written into this column.

- `String getPrefixColumn()`

  Retrieve the name of the column containing the file prefix.

- `void setFileNameColumn(String fileNameColumnName)`

  For an upload to a database table other than the default `fileaccess` table, use this method to specify the name of the column containing the file name. (In `fileaccess`, this column name is `filename`.) File names will include any file name extensions.

- `String getFileNameColumn()`

  Retrieve the name of the column containing the file name.

- `void setDataColumn(String dataColumnName)`

  For an upload to a database table other than the default `fileaccess` table, use this method to specify the name of the BLOB or CLOB column containing the file contents. (In `fileaccess`, this column name is `data`.)

- `String getDataColumn()`

  Retrieve the name of the column containing the file contents.

- `void setConnection(ConnBean conn)`

- `void setConnection(java.sql.Connection conn)`

  For an upload to a database table (default table or otherwise), use this overloaded method to provide a database connection. You can provide an instance of either `oracle.jsp.dbutil.ConnBean` or the standard `java.sql.Connection` type. For information about the `ConnBean` JavaBean, see "ConnBean for a Database Connection" on page 4-4.

  If you use a `Connection` instance, you must explicitly open and close it. For a `ConnBean` instance, this is handled automatically.

- `java.util.Enumeration getFileNames()`

  This method returns an `Enumeration` instance containing the names of the files that were uploaded. (This functionality is not available through the `httpUpload` tag.)

Example: This example uses a plain HTML form to specify a file to upload to a file system, then uses a JSP page that employs `HttpUploadBean` for the upload.

Here is the HTML form, which specifies `beanUploadExample.jsp` for its action and will generate the multipart upload stream.

```
<html><body>
<form action="beanUploadExample.jsp" ENCTYPE="multipart/form-data" method=POST>
<br> File to upload: <INPUT TYPE="FILE" NAME="File" SIZE="50" MAXLENGTH="120" >
<br><INPUT TYPE="SUBMIT" NAME="Submit" VALUE="Send"> </form>
</body></html>
```

And here is the `beanUploadExample.jsp` page.

```
<%@ page language="java"
         import="java.util.*, oracle.jsp.webutil.fileaccess.*" %>
<html><body>
<% String userdir = "fileaccess"; %>   // user's part of the upload directory
<jsp:useBean id="upbean"
   class="oracle.jsp.webutil.fileaccess.HttpUploadBean" >
   <jsp:setProperty name="upbean" property="destination" value="<%= userdir %>"
/>
</jsp:useBean>
<%   upbean.setBaseDir(application, request);
         upbean.upload(request);
         Enumeration fileNames = upbean.getFileNames();
         while (fileNames.hasMoreElements()) { %>
              <br><%= (String)fileNames.nextElement() %>
  <% } %>
<br>Done!
</body></html>
```

The HttpDownloadBean

The `oracle.jsp.webutil.fileaccess.HttpDownloadBean` JavaBean provides numerous setter methods for specifying information used for downloading. It also includes most corresponding getter methods. Once you have set all the required and appropriate attributes, use the `listFiles()` method to list the files available for download. The actual downloading is accomplished through `DownloadServlet`, supplied with OC4J, one file at a time. See "The Download Servlet" on page 8-44.

> **Note:** You must construct the URL for `DownloadServlet` in your application code.

`HttpDownloadBean`, as with `HttpUploadBean`, extends `HttpFileAccessBean`, which itself is not intended for public use.

See "Overview of File Uploading" on page 8-29 for related information.

Summary of Required Attributes

The following list summarizes required attributes for `HttpDownloadBean`:

- always required: `source`
- also required for uploads to a database: `sourceType`, `connection`
- also required for downloads from a database table other than the default `fileaccess` table: `table`, `prefixColumn`, `fileNameColumn`, `dataColumn`
- also required for downloads from a database table using a CLOB column for file data: `fileType`

In addition, for a download from a file system, you must call the `setBaseDir()` method to provide a servlet context and HTTP request object so that the bean can find the `fileaccess.properties` file that specifies the base directory.

Methods

Here are descriptions of the public methods of `HttpDownloadBean`.

> **Note:** Many of the attributes and setter methods for `HttpDownloadBean` are the same as for `HttpUploadBean`.

- `void listFiles(javax.servlet.http.HttpServletRequest req) throws FileAccessException`

  Once all required and appropriate bean attributes have been set, use this method to list the files available for download. These are files in the source directory or matching the source database prefix. The `req` parameter is the HTTP response instance. For a JSP page, use the implicit `request` object.

For use from the file list, you can create HREF links to DownloadServlet, passing it each file and file prefix, allowing users to select the link for each file they want to download.

Note: The listFiles() method writes the file names to memory and to the JSP page or servlet. If you later want to access the file names again, use the getFileNames() method, which reads them from memory.

- `java.util.Enumeration getFileNames()`

  This method returns an Enumeration instance containing the names of the files that are available for download. It requires that the listFiles() method was already called—listFiles() writes the file names to memory and to the JSP page or servlet; getFileNames() reads them from memory.

- ```
  void setBaseDir(javax.servlet.ServletContext sc,
                  javax.servlet.http.HttpServletRequest req)
                                  throws FileAccessException
  ```

  For a download from a file system, use this method to determine what to use as the base directory. It gets this information from the fileaccess.properties file in your application /WEB-INF directory, which it finds through the servlet context input parameter. The baseDir setting, together with the source setting, specifies the absolute path to the directory from which files will be downloaded.

  The sc parameter is the servlet context instance for the application. For JSP pages, use the implicit application object.

  The req parameter is for the HTTP request instance to use in requesting the base directory information. For JSP pages, use the implicit request object.

  A base directory is not relevant for downloads from a database.

- `void setSource(String source)`

  This is always required.

  For a download from a file system, source, together with the base directory, specifies the absolute path to the directory from which files will be downloaded. If source is set to "*", then all directories under the base directory will be available for downloading.
  ```

For a download from a database, `source` is used as the file prefix (base directory is not relevant). The prefix is equivalent to a file system path and can be used to group files into a hierarchy. If `recurse` is enabled, "%" will be appended onto the `source` value, and the `WHERE` clause for the query will contain an appropriate `LIKE` clause. Therefore, all files with prefixes that are partially matched by the `source` value will be available for download. If you want to match all rows in the database table, set `source` to "*".

Note: Typically, the `source` value will be based at least partially on user input.

- `void setSourceType(String sourceType) throws FileAccessException`
- `void setSourceType(int sourceType) throws FileAccessException`

  Use the overloaded `setSourceType()` method to specify whether the download is from a file system or a database.

  To download from a database, set `sourceType` to one of the following: the string "`database`", the defined `String` constant `FileAccessUtil.DATABASE`, the `int` value 1, or the defined `int` constant `FileAccessUtil.LOCATION_TYPE_DATABASE`.

  Downloading from a file system is the default, but if you want to specify this explicitly, set `sourceType` to one of the following: the string "`filesystem`", the defined `String` constant `FileAccessUtil.FILESYSTEM`, the `int` value 0, or the defined `int` constant `FileAccessUtil.LOCATION_TYPE_FILESYSTEM`.

  `FileAccessUtil` is in the `oracle.jsp.webutil.fileaccess` package.

- `String getSourceType()`

  Retrieve the source type information. Note there is a getter method for the string version only.

- `void setRecurse(String recurse) throws FileAccessException`
- `void setRecurse(boolean recurse)`

  Use the overloaded `setRecurse()` method to enable or disable recursive downloading, where files in file system subdirectories or with additional

database prefix information will also be available for downloading. As an example of recursive downloading from a database, assume `source` is set to "`/user`". Recursive downloading would also find matches for files with prefixes such as "`/user/bill`" and "`/user/mary`", and also such as "`/user1`", "`/user2`", "`/user1/tom`", and "`/user2/susan`".

Recursive downloading is enabled by default, but you can enable it explicitly with a `recurse` setting of the string "`true`" or the boolean `true`. Disable recursive downloading with a setting of the string "`false`" or the boolean `false`. String settings are case-insensitive. No settings are accepted other than those listed here.

Note: Practically speaking, recursive downloading is of limited value for a file system download. To parallel the server subdirectory structure when downloading files to the client, the subdirectories would have to already exist. `HttpDownloadBean` cannot create the client subdirectories automatically.

- `void setFileType(String fileType)`
  `throws FileAccessException`
- `void setFileType(int fileType) throws FileAccessException`

  For a download from a database, use the overloaded `setFileType()` method to specify whether the data is stored in a BLOB for binary data (the default) or a CLOB for character data. For a CLOB, set `fileType` to one of the following: the string "`character`", the defined `String` constant `FileAccessUtil.CHARACTER_FILE`, or the `int` value 1. To explicitly specify a BLOB, set `fileType` to one of the following: the string "`binary`", the defined `String` constant `FileAccessUtil.BINARY_FILE`, or the `int` value 0. String settings are case-insensitive. No settings are accepted other than those listed here.

  `FileAccessUtil` is in the `oracle.jsp.webutil.fileaccess` package.

- `String getFileType()`

  Retrieve the file type information. Note there is a getter method for the string version only.

- `void setTable(String tableName)`

  For a download from a database table other than the default `fileaccess` table, use this method to specify the table name.

- `String getTable()`

  Retrieve the table name.

- `void setPrefixColumn(String prefixColumnName)`

  For a download from a database table other than the default `fileaccess` table, use this method to specify the name of the column containing the file prefix. (In `fileaccess`, this column name is `fileprefix`.)

- `String getPrefixColumn()`

  Retrieve the name of the column containing the file prefix.

- `void setFileNameColumn(String fileNameColumnName)`

  For a download from a database table other than the default `fileaccess` table, use this method to specify the name of the column containing the file name. (In `fileaccess`, this column name is `filename`.) The file name includes any file name extension.

- `String getFileNameColumn()`

  Retrieve the name of the column containing the file name.

- `void setDataColumn(String dataColumnName)`

  For a download from a database table other than the default `fileaccess` table, use this method to specify the name of the BLOB or CLOB column that holds the file contents. (In `fileaccess`, this column name is `data`.)

- `String getDataColumn()`

  Retrieve the name of the column containing the file contents.

- `void setConnection(ConnBean conn)`
- `void setConnection(java.sql.Connection conn)`

  For a download from a database table (default table or otherwise), use this method to provide a database connection. You can provide an instance of either `oracle.jsp.dbutil.ConnBean` or the standard `java.sql.Connection` type. For information about the `ConnBean` JavaBean, see "ConnBean for a Database Connection" on page 4-4.

If you use a `Connection` instance, you must explicitly open and close it. For a `ConnBean` instance, this is handled automatically.

Example This example is a JSP page that uses `HttpDownloadBean` for a download from a file system. Note that the page must construct the URL for the download servlet.

```
<%@ page language="java" import="java.util.*, oracle.jsp.webutil.fileaccess.*"
%>
<html><body>
<% String servletPath = "/servlet/download/";  // path to the download servlet
   String userDir = "fileaccess/";   // user part of  download directory
%>
<jsp:useBean id="dbean"
   class="oracle.jsp.webutil.access.HttpDownloadBean" >
   <jsp:setProperty name="dbean" property="source" value='<%=userDir %>' />
</jsp:useBean>
<%    dbean.setBaseDir(application, request);
         dbean.listFiles(request); %>
The following files were found:
<%   Enumeration fileNames = dbean.getFileNames();
        while (fileNames.hasMoreElements()) {
               String name = (String)fileNames.nextElement();  %>
              <br><a href="<%= servletPath + name %>" > <%= name %></a>
<%    } %>
<br>Done!
</body></html>
```

The Download Servlet

To use download functionality, through either `HttpDownloadBean` or the `httpDownload` tag, you must have the class `oracle.jsp.webutil.fileaccess.DownloadServlet` available in your Web server.

Its mapping in your Web server must be reflected in your servlet path settings, either through the `servletPath` attribute if you use the `httpDownload` tag, or in your application code if you use `HttpDownloadBean`. For an example of how to configure it in your Web server, see the `/WEB-INF/web.xml` file for the OC4J demos.

The OC4J demos, for example, expect to find `DownloadServlet` mapped to the servlet name `download` with the context path `/j2ee/servlet` (the context root of the OC4J default Web application, using Oracle HTTP Server with Apache JServ

protocol). That is, it must be accessible by the following relative path, unless you edit `web.xml`:

```
/j2ee/servlet/download
```

FileAccessException Class

The `oracle.jsp.webutil.fileaccess.FileAccessException` class is a convenience class supplied with OC4J for file-access exception-handling. It wraps the functionality of the standard `java.sql.SQLException` and `java.io.IOException` classes. It handles exceptions from either of the file-access beans in addition to handling SQL and I/O exceptions.

File Upload and Download Tag Descriptions

For file uploading, OC4J supplies the `httpUpload` tag. This tag, in turn, uses `HttpUploadBean`. For convenience, you can also use the `httpUploadForm` tag in programming the form through which users specify the files to upload, or you can code the form manually.

For file downloading, OC4J provides the custom `httpDownload` tag.This tag uses `HttpDownloadBean`. This section describes these tags and their attributes.

To use the file upload and download tags, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with OC4J.

The tag library descriptor file, `fileaccess.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "fileaccess:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

The httpUploadForm Tag

For convenience, you can use the `httpUploadForm` tag to create a form in your application, using multipart encoded form data, that allows users to specify the files to upload.

Syntax

```
<fileaccess:httpUploadForm formsAction = "action"
                           [ maxFiles = "max_number" ]
                           [ fileNameSize = "file_input_box_num_chars" ]
                           [ maxFileNameSize = "max_file_name_num_chars" ]
                           [ includeNumbers = "true" | "false" ]
                           [ submitButtonText = "button_label_text" ] />
```

Note: The `httpUploadForm` tag can optionally use a body. For example, the body might consist of a user prompt.

Attributes

- `formsAction` (required)—This is to indicate the action that will be performed after the form is submitted. For example, `formsAction` could be the name of a JSP page that uses `HttpUploadBean` or the `httpUpload` tag.
- `maxFiles`—Use this if you want to specify the number of input lines you want to appear in the form. The default is 1.
- `fileNameSize`—Use this if you want to specify the character-width of the file name input box (or boxes). The default is 20 characters.
- `maxFileNameSize`—Use this if you want to specify the maximum number of characters allowed in a file name. The default is 80 characters.
- `includeNumbers`—Set this to "`true`" if you want the file name input boxes to be numbered. The default setting is "`false`".
- `submitButtonText`—Use this if you want to specify the text that appears on the "submit" button of the form. The default is "`Send`".

The httpUpload Tag

This tag wraps the functionality of the `HttpUploadBean` JavaBean, paralleling its attributes. See "Overview of File Uploading" on page 8-29 and "The HttpUploadBean" on page 8-33 for related information.

Syntax

```
<fileaccess:httpUpload destination = "dir_path_or_prefix"
                  [ destinationType = "filesystem" | "database" ]
                  [ connId = "id" ]
                  [ scope = "request" | "page" | "session" | "applicaton" ]
                  [ overwrite = "true" | "false" ]
                  [ fileType = "character" | "binary" ]
                  [ table = "table_name" ]
                  [ prefixColumn = "column_name" ]
                  [ fileNameColumn = "column_name" ]
                  [ dataColumn = "column_name" ] />
```

Note: For uploads to a file system, the base directory is automatically retrievable by the tag handler from the JSP page context.

Attributes

- `destination` (required)—For uploading to a file system, this indicates the path, beneath the base directory supplied in the `/WEB-INF/fileaccess.properties` file, of the directory into which files will be uploaded. For uploading to a database, `destination` indicates the file prefix, conceptually equivalent to a file system path.

Note: Typically, the `destination` value will be based at least partially on user input.

- `destinationType`—Set this to "`database`" for uploading to a database. The default is to upload to a file system, but you can also explicitly set it to "`filesystem`". These values are case-insensitive.
- `connId`—For uploading to a database, use this attribute to provide a `ConnBean` connection ID for the database connection to be used. Or, alternatively, use the `httpUpload` tag inside a `dbOpen` tag to implicitly use the `dbOpen` connection. For information about the `ConnBean` JavaBean and `dbOpen` tag provided with OC4J, see Chapter 4, "Data-Access JavaBeans and Tags".

- `scope`—For uploading to a database, use this attribute to specify the scope of the `ConnBean` instance for the connection. The scope setting here must match the scope setting when the `ConnBean` instance was created, such as in a `dbOpen` tag. If the `httpUpload` tag is nested inside a `dbOpen` tag, then there is no need to specify `connId` or `scope`—that information will be taken from the `dbOpen` tag. Otherwise, the default scope setting is "`page`".
- `overwrite`—Set this to "`false`" if you do not want to overwrite existing files that have the same paths and names as the files you are uploading, or if you do not want to update rows with the same file name and prefix for database uploading. In this case, an error will be generated if a file already exists. By default, `overwrite` is set to "`true`" and `httpUpload` overwrites files.
- `fileType`—For uploading to a database, set this attribute to "`character`" for character data, which will be written into a CLOB. The default setting is "`binary`" for binary data, which will be written into a BLOB.
- `table`—For uploading to a database table other than the default `fileaccess` table, use this attribute to specify the table name.
- `prefixColumn`—For uploading to a database table other than the default `fileaccess` table, use this attribute to specify the name of the column containing file prefixes. This column is where the `destination` values will be written.
- `fileNameColumn`—For uploading to a database table other than the default `fileaccess` table, use this attribute to specify the name of the column containing file names.
- `dataColumn`—For uploading to a database table other than the default `fileaccess` table, use this attribute to specify the name of the column containing file contents.

Example This example has a page that uses the `httpUploadForm` tag to create the HTML form for specifying files to upload. The `httpUploadForm` tag specifies `httpUploadExample.jsp` as its forms action. The `httpUploadExample.jsp` page uses the `httpUpload` tag to upload to the default `fileaccess` table in a database.

Here is the page for the HTML form:

```
<%@ page language="java" import="java.io.*"  %>
<%@ taglib uri="/WEB-INF/fileaccess.tld" prefix="upload" %>
<html> <body>
```

```
<fileaccess:httpUploadForm
      formsAction="httpUploadExample.jsp"
      maxFiles='<%= request.getParameter("MaxFiles") %>'
      includeNumbers="true"  fileNameSize="50"  maxFileNameSize="120" >
          <br> File:
</fileaccess:httpUploadForm>
</body> </html>
```

And following is the `httpUploadExample.jsp` page. Note that the `httpUpload` tag gets its database connection as a result of being inside a `dbOpen` tag. Also note that `setconn.jsp` is used to obtain the connection, if necessary. See "setconn.jsp" on page 5-12.

```
<%@ page language="java" %>
<%@ taglib uri="/WEB-INF/fileaccess.tld" prefix="upload" %>
<%@ taglib uri="/WEB-INF/sqltaglib.tld" prefix="sql" %>
<% String connStr=request.getParameter("connStr"); // get the connection string
       if (connStr==null) {  connStr=(String)session.getValue("connStr"); }
       else {  session.putValue("connStr",connStr); }
       if (connStr==null) { %>
           <jsp:forward page="setconn.jsp" />
<% } %>
<html><body>
<sql:dbOpen URL="<%= connStr %>" user="scott" password="tiger" >
   <fileaccess:httpUpload  destinationType = "database"
                           destination="tagexample" />
</sql:dbOpen>
Done! </body></html>
```

The httpDownload Tag

This tag wraps the functionality of the `HttpDownloadBean` JavaBean, paralleling its attributes. See "Overview of File Downloading" on page 8-31 and "The HttpDownloadBean" on page 8-38 for related information.

Syntax

```
<fileaccess:httpDownload servletPath = "path"
                   source = "dir_path_or_prefix"
                 [ sourceType = "filesystem" | "database" ]
                 [ connId = "id" ]
                 [ scope = "request" | "page" | "session" | "applicaton" ]
                 [ recurse = "true" | "false" ]
                 [ fileType = "character" | "binary" ]
```

```
[ table = "table_name" ]
[ prefixColumn = "column_name" ]
[ fileNameColumn = "column_name" ]
[ dataColumn = "column_name" ] />
```

Notes:

- The `httpDownload` tag can optionally use a body. For example, the body might consist of a user prompt.
- For downloads from a file system, the base directory is automatically retrievable by the tag handler from the JSP page context.

Attributes

- `servletPath` (required)—This is the path to the Oracle `DownloadServlet`, which executes the actual download of each file. For example, if `DownloadServlet` has been installed in the application `app` and mapped to the name `download`, then use "`/app/download/`", with leading and trailing slashes, as the `servletPath` setting. The `httpDownload` tag handler uses this path in constructing the URL to `DownloadServlet`.

  See "The Download Servlet" on page 8-44 for more information about this servlet.

- `source` (required)—For downloading from a file system, this attribute indicates the path, beneath the base directory supplied in the file `/WEB-INF/fileaccess.properties`, of the directory from which files are retrieved. A value of "`*`" results in all directories under the base directory being available.

  For downloading from a database, this attribute indicates the file prefix, conceptually equivalent to a file system path. If `recurse` is enabled, "`%`" will be appended onto the `source` value, and the `WHERE` clause for the query will contain an appropriate `LIKE` clause. Therefore, all files with prefixes that are partially matched by the source value will be available for download. If you want to match all rows in the database table, set `source` to "`*`".

Note: Typically, the `source` value is based at least partially on user input.

- `sourceType`—Set this to "`database`" for downloading from a database. The default is to download from a file system, or you can explicitly set this to "`filesystem`".
- `connId`—For downloading from a database, use this attribute to provide a `ConnBean` connection ID for the database connection to be used. Or, alternatively, you can use the `httpDownload` tag inside a `dbOpen` tag to implicitly use the `dbOpen` connection. For information about the `ConnBean` JavaBean and `dbOpen` tag provided with OC4J, see Chapter 4, "Data-Access JavaBeans and Tags".
- `scope`—For downloading from a database, use this attribute to specify the scope of the `ConnBean` instance for the connection. The scope setting here must match the scope setting when the `ConnBean` instance was created, such as in a `dbOpen` tag. If the `httpDownload` tag is nested inside a `dbOpen` tag, then there is no need to specify `connId` or `scope`—that information will be taken from the `dbOpen` tag. Otherwise, the default scope setting is "`page`".
- `recurse`—Set this to "`false`" if you do not want recursive downloading, where files in file system subdirectories or with additional database prefix information will also be available for download. As an example of recursive downloading from a database, assume you have set `source` to "`/user`". Recursive downloading would also find matches for files with prefixes such as "`/user/bill`" and "`/user/mary`", and also such as "`/user1`", "`/user2`", "`/user1/tom`", and "`/user2/susan`". The default is recursive downloading, or you can enable it explicitly with a setting of "`true`".
- `fileType`—For downloading from a database, set this attribute to "`character`" for character data, which will be retrieved from a CLOB. The default setting is "`binary`" for binary data, which will be retrieved from a BLOB.
- `table`—For downloading from a database table other than the default `fileaccess` table, use this attribute to specify the table name.
- `prefixColumn`—For downloading from a database table other than the default `fileaccess` table, use this attribute to specify the name of the column containing file prefixes, which is where `source` values are stored.
- `fileNameColumn`—For downloading from a database table other than the default `fileaccess` table, use this attribute to specify the name of the column containing file names. File names include any file name extensions.

- `dataColumn`—For downloading from a database table other than the default `fileaccess` table, use this attribute to specify the name of the column that stores the file contents.

Example This example is a JSP page that uses the `httpDownload` tag to download from the default `fileaccess` table of a database. The tag body content ("`<br>:`") will be output before each file name in the list of files available for download. Note that you must specify the `DownloadServlet` servlet path in the `httpDownload` tag; the tag handler will use it in constructing the URL to `DownloadServlet`, which performs the actual downloading.

```
<%@ page language="java" %>
<%@ taglib uri="/WEB-INF/fileaccess.tld" prefix="download" %>
<%@ taglib uri="/WEB-INF/sqltaglib.tld" prefix="sql" %>
<% String connStr=request.getParameter("connStr");
       if (connStr==null) { connStr=(String)session.getValue("connStr");}
       else { session.putValue("connStr",connStr);}
       if (connStr==null) { %>
          <jsp:forward page="setconn.jsp" />
<% } %>
<html> <body>
<% String servletPath = "/servlet/download/"; %>
<sql:dbOpen URL="<%= connStr %>" user="scott" password="tiger" >
<fileaccess:httpDownload sourceType = "database"
           source="tagexample" servletPath = '<%= servletPath %>' >
   <br>:
</fileaccess:httpDownload>
</sql:dbOpen>
<br>Done!
</body> </html>
```

EJB Tags

OC4J provides a custom tag library to simplify the use of Enterprise JavaBeans in JSP pages.

The functionality of the OC4J EJB tags follows the J2EE specification. The tags allow you to instantiate EJBs by name, using configuration information in the `web.xml` file. One of the tags is a `useBean` tag, with functionality similar to that of the standard `jsp:useBean` tag for invoking a regular JavaBean.

The rest of this section is organized as follows:

- EJB Tag Configuration
- EJB Tag Descriptions
- EJB Tag Examples

EJB Tag Configuration

Use an `<ejb-ref>` element in your application `web.xml` file for each EJB you will use, as in the following example:

```
<ejb-ref>
   <ejb-ref-name>ejb/DemoSession</ejb-ref-name>
   <ejb-ref-type>Session</ejb-ref-type>
   <home>ejbdemo.DemoSessionHome</home>
   <remote>ejbdemo.DemoSession</remote>
</ejb-ref>
```

The `<ejb-ref>` element and its subelements are used according to the Sun Microsystems *Servlet Specification, Version 2.2* (or higher). Briefly, this is as follows:

- The `<ejb-ref-name>` subelement specifies a reference name that can be used by other components of a J2EE application to access this component. For example, this name could be used in a location value.
- The `<ejb-ref-type>` subelement specifies the category of EJB.
- The `<home>` subelement specifies the package and type of the EJB home interface.
- The `<remote>` subelement specifies the package and type of the EJB remote interface.

These values are reflected in attribute values of the EJB tags.

EJB Tag Descriptions

This section provides syntax and attribute descriptions for the OC4J EJB tags.

To use the EJB tags, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with OC4J.

The tag library descriptor file, `ejbtaglib.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "ejb:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

The following tags are available:

- EJB useHome Tag
- EJB useBean Tag
- EJB createBean Tag
- EJB iterate Tag

When first creating an EJB instance, you will have to use a `useHome` tag to create a home interface instance, then the following as appropriate:

- to create a single EJB instance: a `useBean` tag, and either the `useBean` tag `value` attribute or a nested `createBean` tag
- to create a collection of EJB instances and iterate through them (more typical for entity beans): an `iterate` tag

After an EJB instance is created, it is placed in the appropriate scope object, and you will need only a `useBean` tag to access it subsequently.

EJB useHome Tag

The `useHome` tag looks up the home interface for the EJB and creates an instance of it.

Syntax

```
<ejb:useHome id = "home_instance_name"
             type = "home_interface_type"
             location = "home_lookup_name" />
```

This tag uses no body.

Attributes

- `id` (required)—Specify a name for the home interface instance. The instance is accessible from the start-tag to the end of the page.
- `type` (required)—This is for the name (Java type) of the home interface.
- `location` (required)—This is a JNDI name used to look up the home interface of the desired EJB within the application.

Example

```
<ejb:useHome id="aomHome" type="com.acme.atm.ejb.AccountOwnerManagerHome"
             location="java:comp/env/ejb/accountOwnerManager" />
```

EJB useBean Tag

Use the EJB `useBean` tag for instantiating and using the EJB. The `id`, `type`, and `scope` attributes are used as in a standard `jsp:useBean` tag that instantiates a regular JavaBean.

You can use one of two mechanisms when you first instantiate the EJB:

- the `value` attribute

or:

- a nested EJB `createBean` tag

When using a `createBean` tag, the EJB instance is implicitly returned into the `value` attribute of the parent `useBean` tag. Once the EJB is instantiated, `value` attributes and nested `createBean` tags are unnecessary for subsequent `useBean` tags using the same EJB instance.

Note: See "EJB iterate Tag" on page 8-57 for how to use a collection of EJB instances.

Syntax

```
<ejb:useBean id = "EJB_instance_name"
             type = "EJB_class_name"
           [ value = "<%=Object%>" ]
           [ scope = "page" | "request" | "session" | "application" ]  >

... nested createBean tag for first instantiation (if no value attribute) ...

</ejb:useBean>
```

Attributes

- `id` (required)—Specify an instance name for the EJB.
- `type` (required)—This is the class name for the EJB.
- `value`—When first instantiating the EJB, if you do not use a nested `createBean` tag, you can use the `value` attribute to return an `EJBObject` instance to narrow. This is a mechanism for instantiating the EJB.
- `scope`—Specify the scope of the EJB instance. The default scope setting is "`page`".

Example This example shows the use of an EJB that has already been instantiated.

```
<ejb:useBean id="bean" type="com.acme.MyBean" scope="session" />
```

EJB createBean Tag

For first instantiating an EJB, if you do not use the `value` attribute of the EJB `useBean` tag, you must nest an EJB `createBean` tag within the `useBean` tag to do the work of creating the EJB instance. This will be an `EJBObject` instance. The instance is implicitly returned into the `value` attribute of the parent `useBean` tag.

Syntax

```
<ejb:createBean instance = "<%=Object%>" />
```

This tag uses no body.

Attributes

- `instance` (required)—This is to return the EJB, a created `EJBObject` instance.

Example In this `createBean` tag, the `create()` method of the EJB home interface instance creates an instance of the EJB.

```
<ejb:useBean id="bean" type="com.acme.MyBean" scope="session">
     <ejb:createBean instance="<%=home.create()%>" />
</ejb:useBean>
```

EJB iterate Tag

Use this tag to iterate through a collection of EJB instances. This is more typical for entity beans, because standard finder methods for entity beans return collections.

In the start-tag, obtain the collection through finder results from the home interface. In the tag body, iterate through the collection as appropriate.

Notes:

- This tag has the same semantics as the more general `iterate` utility tag, discussed in "Utility iterate Tag" on page 8-63. It is copied into the EJB tag library for convenience.
- See "EJB useBean Tag" on page 8-55 for how to use a single EJB instance.

Syntax

```
<ejb:iterate id = "EJB_instance_name"
             type = "EJB_class_name"
             collection = "<%=Collection%>"
           [ max = "<%=Integer%>" ] >

... body ...

</ejb:iterate>
```

The body is evaluated once for each EJB in the collection.

Attributes

- `id` (required)—This is an iterator variable, the EJB instance name for each iteration.
- `type` (required)—This is the EJB class name.
- `collection` (required)—This is to return the EJB collection.
- `max`—Optionally specify a maximum number of beans to iterate through.

Example

```
<ejb:iterate id="account" type="com.acme.atm.ejb.Account"
             collection="<%=accountManager.getOwnerAccounts()%>"
             max="100">
     <jsp:getProperty name="account" property="id" />
</ejb:iterate>
```

EJB Tag Examples

This section provides examples of EJB tag usage, one using a session bean and one using an entity bean.

EJB Tag Session Bean Example

This example relies on the following configuration in the application `web.xml` file:

```
<ejb-ref>
   <ejb-ref-name>ejb/DemoSession</ejb-ref-name>
   <ejb-ref-type>Session</ejb-ref-type>
   <home>ejbdemo.DemoSessionHome</home>
   <remote>ejbdemo.DemoSession</remote>
</ejb-ref>
```

Here is the sample code:

```
<%@ page import="ejbdemo.*" %>
<%@ taglib uri="/WEB-INF/ejbtaglib.tld" prefix="ejb" %>
<html>
<head> <title>Use EJB from JSP</title> </head>
<body>

<ejb:useHome id="home" type="ejbdemo.DemoSessionHome"
             location="java:comp/env/ejb/DemoSession" />
```

```
<ejb:useBean id="demo" type="ejbdemo.DemoSession" scope="session" >
    <ejb:createBean instance="<%=home.create()%>" />
</ejb:useBean>
<heading2>      Enterprise Java Bean:  </heading2>
 <p><b> My name is "<%=demo.getName()%>". </b></p>
</body>
</html>
```

This sample code accomplishes the following:

- It creates the `home` instance of the EJB home interface. Note that the `type` value of the `useHome` tag matches the `<home>` value of the `<ejb-ref>` element in the `web.xml` file, and that the `location` value of `useHome` reflects the `<ejb-ref-name>` value of the `<ejb-ref>` element.
- It uses the `home.create()` method to create the `demo` instance of the EJB. Note that the `type` value of the `useBean` tag matches the `<remote>` value of the `<ejb-ref>` element in the `web.xml` file.
- It uses the `demo.getName()` method to print a user name.

EJB Tag Entity Bean Example

This example relies on the following configuration in the application `web.xml` file:

```
<ejb-ref>
   <ejb-ref-name>ejb/DemoEntity</ejb-ref-name>
   <ejb-ref-type>Entity</ejb-ref-type>
   <home>ejbdemo.DemoEntityHome</home>
   <remote>ejbdemo.DemoEntity</remote>
</ejb-ref>
```

Here is the sample code:

```
<%@ page import="ejbdemo.*" %>
<%@ taglib uri="/WEB-INF/ejbtaglib.tld" prefix="ejb" %>
<html>
<head> <title>Iterate over EJBs from JSP</title> </head>
<body>

<ejb:useHome id="home" type="ejbdemo.DemoEntityHome"
             location="java:comp/env/ejb/DemoEntity" />
<% int i=0; %>
<ejb:iterate id="demo" type="ejbdemo.DemoEntity"
             collection="<%=home.findAll()%>" max="3" >
<li> <heading2> Bean #<%=++i%>:  </heading2>
```

```
 <b> My name is "<%=demo.getName()+"_"+ demo.getId()%>". </b> </li>
</ejb:iterate>
</body>
</html>
```

This sample code accomplishes the following:

- It creates the `home` instance of the EJB home interface. Note that the `type` value of the `useHome` tag matches the `<home>` value of the `<ejb-ref>` element in the `web.xml` file, and that the `location` value of `useHome` reflects the `<ejb-ref-name>` value of the `<ejb-ref>` element.
- It uses the `home.findAll()` method to return a collection of EJBs. Note that the `type` value in the `iterate` tag matches the `<remote>` value of the `<ejb-ref>` element in the `web.xml` file.
- It iterates through the collection, always using `demo` for the current instance, and using the `demo.getName()` and `demo.getId()` methods to output information from each EJB.

General Utility Tags

OC4J provides a number of miscellaneous utility tags to perform a variety of operations. This section documents these tags and is organized as follows:

- Display Tags
- Miscellaneous Utility Tags

To use the utility tags, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with OC4J.

The tag library descriptor file, `utiltaglib.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "util:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

Display Tags

This section documents the following tags:

- Utility displayCurrency Tag
- Utility displayDate Tag
- Utility displayNumber Tag

Utility displayCurrency Tag

This tag displays a specified amount of money, formatted as currency appropriate for the locale. If no locale is specified, then the `request` object will be searched for a locale. If none is found there, the system default locale is used.

Syntax

```
<util:displayCurrency amount = "<%=Double%>"
                    [ locale = "<%=Locale%>" ] />
```

This tag uses no body.

Attributes

- `amount` (required)—Specify the amount to format.
- `locale`—Optionally specify a locale (a `java.util.Locale` instance).

Example

```
<util:displayCurrency amount="<%=account.getBalance()%>"
                      locale="<%=account.getLocale()%>" />
```

Utility displayDate Tag

This tag displays a specified date, formatted appropriately for the locale. If no locale is specified, the system default locale is used.

Syntax

```
<util:displayDate date = "<%=Date%>"
                [ locale = "<%=Locale%>" ] />
```

This tag uses no body.

Attributes

- `date` (required)—Specify the date to format (a `java.util.Date` instance).
- `locale`—Optionally specify a locale (a `java.util.Locale` instance).

Example

```
<util:displayDate date="<%=account.getDate()%>"
                  locale="<%=account.getLocale()%>" />
```

Utility displayNumber Tag

This displays the specified number, for the locale and optionally in the specified format. If no locale is specified, the system default locale is used.

Syntax

```
<util:displayNumber number = "<%=Double%>"
                    [ locale = "<%=Locale%>" ]
                    [ format = "<%=Format%>" ] />
```

This tag uses no body.

Attributes

- `number` (required)—Specify the number to format.
- `locale`—Optionally specify the locale (a `java.util.Locale` instance).
- `format`—Optionally specify a format (a `java.text.Format` instance).

Example

```
<util:displayNumber number="<%=shoe.getSize()%>" />
```

Miscellaneous Utility Tags

This section documents the following tags:

Utility iterate Tag

Use this tag to iterate through a collection. Obtain the collection in the start-tag; iterate through it in the body.

Syntax

```
<util:iterate id = "instance_name"
              type = "class_name"
              collection = "<%=Collection%>"
            [ max = "<%=Integer%>" ] >

... body ...

</util:iterate>
```

The body is evaluated once for each element in the collection.

Attributes

- `id` (required)—This is an iterator variable, the instance name for each iteration.
- `type` (required)—This is the class name; the collection is a set of instances of this type.
- `collection` (required)—This is the collection itself.
- `max`—Optionally specify a maximum number of elements to iterate through.

Example

```
<util:iterate id="contact" type="com.acme.connections.Contact"
              collection="<%=company.getContacts()%>" >
     <jsp:getProperty name="contact" property="name"/>
</util:iterate>
```

Utility ifInRole Tag

Use this tag to evaluate the tag body and include it in the body of the JSP page, depending on whether the user is in the specified application role. The tag handler executes the `isUserInRole()` method of the `request` object.

The concept of "role" is according to the Sun Microsystems *Java Servlet Specification, Version 2.2* (and higher). Roles are defined in `<role>` elements in the application `web.xml` file.

Syntax

```
<util:ifInRole role = "<%=String%>"
             [ include = "true" | "false" ] >

   ... body to include ...

</util:ifInRole>
```

Attributes

- `role` (required)—Check to see if the user is in this specified role.

- `include`—Use a "`true`" setting (the default) to include the body only if the user is in the role. Use a "`false`" setting to include the body only if the user is *not* in the role.

Example

```
<util:ifInRole role="users" include="true">
     Logged in as <%=request.getRemoteUser()%><br>
     <form action="logout.jsp">
     <input type="submit" value="Log out"><br>
     </form>
</util:ifInRole>
<util:ifInRole role="users" include="false">
     <form method="POST">
     Username: <input name="j_username" type="text"><br>
     Password: <input name="j_password" type="password"><br>
     <input type="submit" value="Log in">
     </form>
</util:ifInRole>
```

Utility lastModified Tag

This tag displays the date of the last modification of the current file, appropriately formatted for the locale. If no locale is specified, then the `request` object will be searched for a locale. If none is found there, the system default locale is used.

Syntax

```
<util:lastModified
            [ locale = "<%=Locale%>" ] />
```

This tag uses no body.

Attributes

- `locale`—Optionally specify the locale (a `java.util.Locale` instance).

Example

```
<util:lastModified />
```

9

Oracle9*i*AS Personalization Tags

This chapter documents the tag library supplied with OC4J for use with Oracle9*i*AS Personalization. Use of this library assumes that the Oracle9*i*AS Personalization product has been properly installed.

This chapter covers the following topics:

For information about Oracle9*i*AS Personalization itself, see the *Oracle9iAS Personalization Administrator's Guide* and the *Oracle9iAS Personalization Programmer's Guide*.

Overview of Personalization

This section introduces personalization, first covering general concepts and then providing an overview of the Oracle implementation in particular.

General Overview of Personalization

This overview covers general personalization concepts and describes the differences between *personalization* and *customization*, concepts that are sometimes confused.

Personalization Concepts

Personalization is a mechanism to tailor recommendations to application users, based on behavioral, purchasing, rating, and demographic data. Recommendations are made in real-time, during a user's application session. User behavior is saved to a profile in a database repository for use in building models to predict future user behavior.

In future user sessions, the models are used to predict behavior and desires of similar users (or, within a single session, the same user), such as products or services to purchase or Web sites to visit. The user will receive recommendations based on these predictions.

The Oracle9*i*AS Personalization tag library exposes two key functions of personalization:

- choosing the most relevant content to deliver, based on past user behavior as collected in the user profile
- embedding this personalized content into application output or Web pages in a flexible manner

A typical personalization scheme may take any or all of the following into account:

- user Web-surfing patterns
- past user purchase activities
- past user ratings of items
- anticipated nature and degree of user interest (such as "buy" versus "like")
- user demographics, such as age, sex, and income

Note: The concept of personalization is not limited to Web sites and Web applications. You can use personalization in any application where there is appropriate data and a need for personalized recommendations, such as CRM applications. Web applications are the focus of this particular document, however.

Personalization Versus Customization

Personalization, as implemented by Oracle and described in this chapter, is a complex and dynamic set of features that result in content being chosen automatically and implicitly. It should not be confused with simpler and more static Web site mechanisms that are often referred to as "personalization", but are really simply "customization".

Many sites offer customization such as giving a user a set of possible topics of interest—such as local weather, stocks of interest, or favorite sports—then displaying output based on the chosen topic. Although it is true that this personalizes the content that is delivered, the process is static and requires explicit user involvement. The focus of the content does not change until the user has an opportunity to change it explicitly through another topic selection.

Personalization chooses content for the user automatically, without direct user request. The process of choosing content is hidden. Moreover, as the system becomes more familiar with user habits by observing behavior, it achieves increased accuracy in predicting future behavior and interests.

Introduction to Oracle9*i*AS Personalization

Oracle9*i*AS Personalization uses data mining algorithms in the Oracle database to choose the most relevant content available for a user. Recommendations are calculated by an Oracle9*i*AS Personalization recommendation engine (defined in "Introduction to Recommendation Engines" on page 9-5), typically using large amounts of data regarding past and current user behavior. This approach is superior to others that rely on common-sense heuristics and require manual definition of rules in the system.

The application that uses Oracle9*i*AS Personalization controls data collection, with Oracle9*i*AS Personalization itself providing targeted data. This process allows the application to avoid collecting large volumes of data of only minimal usefulness.

The Oracle9*i*AS Personalization tag library brings this functionality to a wide audience of JSP developers for use in HTML, XML, or JavaScript pages. The tag

interface is layered on top of the lower-level Java API of the recommendation engine.

Basis for Recommendations

Depending on the configuration and tuning of an Oracle9*i*AS Personalization environment, recommendations may be based on one or more factors such as the following:

- past behavior of similar users, according to demographics
- behavior of past users who have shown the same interests, such as a general trend being established that users who look at items 1, 2, and 3 are likely to be interested in items 5 and 6 as well, without considering the demographics or profiles of the users
- behavior of the same user earlier in the current session, allowing user-specific personalization even for first-time users or anonymous visitors, as well as providing a high degree of tuning regarding the purpose of the current visit
- *hot picks* recommendations, based on current promotions, features of the week, and so on, which may or may not account for user identity

Key Components

Oracle9*i*AS Personalization includes the following key components:

- mining table repository (MTR)
- mining object repository (MOR)
- recommendation engine farm, consisting of one or more recommendation engines
- recommendation engine Java API

These are all introduced in upcoming sections.

Introduction to Mining Table Repository

The Oracle9*i*AS Personalization *Mining Table Repository* (MTR) contains the schema and data to be used for data mining. It is a set of database tables and views containing the following:

- records of previous user behavior
- data collected elsewhere and imported into the repository
- user demographics

These factors are taken together for use in building models to predict future user preferences.

Introduction to Models

A *model* is essentially a collection of rules deduced from user data. A simplified example of a rule is "female over 55, income between $150,000 and $200,000, recently purchased scuba tank and mask, likely to buy fins and thermal suit".

In Oracle9*i*AS Personalization, a model is developed according to recorded facts gathered from the mining table repository. Rules in the model are deduced strictly from available data, not from general or common-sense assumptions of what might be typical for a certain classification of person. How close a particular user's characteristics are to the rules of the best available model determines the likelihood of the resulting recommendation being correct or appropriate.

Introduction to Mining Object Repository

The Oracle9*i*AS Personalization *Mining Object Repository* (MOR) is a database schema that maintains mining meta data and mining model results as defined in the Oracle9*i*AS Personalization data mining schema. The mining object repository serves as the focus for logging in to the data mining system, logging off, and scheduling Oracle9*i*AS Personalization events. The building of models out of the mining table repository is accomplished according to Oracle9*i*AS Personalization data mining algorithms.

It is possible to build different models out of the same data by tuning the relevant algorithm to weigh different characteristics of the data more or less heavily. Therefore, there may be multiple models in the mining object repository for a given situation, but only one model is deployed into a recommendation engine at any particular time.

Introduction to Recommendation Engines

An Oracle9*i*AS Personalization *Recommendation Engine* (RE) is an Oracle database schema that downloads an Oracle9*i*AS Personalization model during deployment, and fetches appropriate user profile data from the mining table repository when processing a request for recommendations. Each engine is responsible for activities such as the following:

- Load and hold model data.
- Process recommendation requests.
- Collect user profile data.

A recommendation engine processes recommendation requests at runtime and produces personalized recommendations. It also tracks current user behavior at the Web site, collecting user profile data during a session. This latter features allows session-specific personalization for anonymous users and registered users alike.

Populating a recommendation engine involves building a model and then deploying it to a recommendation engine schema, steps that happen behind the scenes. The calculation of particular recommendations is accomplished by PL/SQL stored procedures in the schema.

Introduction to Recommendation Engine Farms

A recommendation engine must be part of a *recommendation engine farm*. All engines in a farm are loaded with the same model and can be used interchangeably. It is permissible for a farm to consist of only one engine; however, for load-balancing and failover purposes, it is advisable to have multiple engines in the farm. To accomplish the desired effect, these engines would reside in different databases on different physical systems.

Overview of Recommendation Engine API Concepts and Features

Oracle9*i*AS Personalization provides a Java API for use with recommendation engines. The primary use of the API is for requesting recommendations for appropriate items for a given user. The API essentially acts as a client interface to the stored procedures of a recommendation engine database schema. Calculation of recommendations is accomplished through JDBC calls to the stored procedures, using JDBC connection pooling.

The Java API also provides short-term storage, referred to as the *data collection cache*, for collecting user profile data. These data are periodically flushed to recommendation engine tables, and from there to the mining table repository. Caching the data in this way, instead of immediately writing user data to the recommendation engine as it is gathered, minimizes the number of JDBC calls required. Be aware, however, that each time a recommendation is requested, this *does* result in a synchronous JDBC call. Results of recommendation requests are not cached, because of their unique and personalized nature.

For JSP programmers, the functionality of the recommendation engine Java API is wrapped in the functionality of the Oracle9*i*AS Personalization tag library, so this document does not discuss details of the Java API. The tag library provides programming convenience, automating features that you must manage explicitly if you use the Java API directly.

The rest of this section provides an overview of the following concepts and features for the Oracle9*i*AS Personalization recommendation engine:

- Visitors Versus Customers
- Items, Recommendations, Taxonomies, and Categories
- Ratings and Rankings
- Stateful Versus Stateless Recommendation Engine Sessions
- Requests for Recommendations

Visitors Versus Customers

The recommendation engine has two classifications of users:

- *visitor*—This is an anonymous user who is not recognized and does not have a demographic profile or a stored history of past behavior, preferences, and actions.
- *customer*—This is a registered user who is therefore recognized, and has a demographic profile and stored history of behavior to be used in generating accurate recommendations.

> **Note:** An anonymous visitor can be converted into a registered user in the middle of a session—at the time of registration, for example. See "Personalization setVisitorToCustomer Tag" on page 9-31.

Items, Recommendations, Taxonomies, and Categories

In Oracle9*i*AS Personalization, *item* is a generic concept referring to a single article or the smallest unit of information. Following are some examples:

- a product
- a service to purchase
- a URL selected by a user
- a piece of demographic data such as a user's gender or age

Items are used in several ways:

- They can be passed to item-recording tags for the recording of user data. In this situation they are sometimes referred to as *data items*.

- They can be returned as suggestions. In this situation, they are referred to as *recommendations*. For each item returned as a recommendation, there is also a prediction value, which is either a rating or a ranking. These terms are discussed in "Ratings and Rankings" on page 9-9.
- They can be passed as input when the application requests recommendations. This is done for *cross-selling*, where recommended items are based on past items, or to evaluate and rate or rank a particular set of items.

All individual items in an inventory system must belong to a *taxonomy*. In Oracle9*i*AS Personalization, a taxonomy refers to a structural organization of items. Typically, the organization of items has a hierarchical structure like a tree or collection of trees, branching from broader groups at the trunk to individual items at the leaves. Item membership in a taxonomy is not exclusive—it is possible to include the same item in multiple taxonomies. A taxonomy is represented by a taxonomy ID, which is a long integer.

Catalog or Web site hosting applications can distinguish among their client data sets by using different taxonomy IDs for different client catalogs or Web sites. Appropriate processing is used to distinguish between classifications of users so that an appropriate taxonomy can be used in each case. For example, a customer at `www.oracle.com` may indicate that she is a DBA or Web developer. This will determine the taxonomy used in personalizing her future visits. The offering of promotional campaigns, banners, and available books and training, for example, would be drawn either from a Web productivity tools taxonomy or a database administration tools taxonomy.

Individual items within a taxonomy can be grouped into *categories*. In the structure of a taxonomy, categories are intermediate nodes, consisting of groups of related items. Note, however, that any given item can belong to multiple categories. As an example, the movie *The English Patient* might belong to categories such as "Screen Adaptations of Novels", "Oscar Winners", "Foreign", and "Drama".

Generally, an item is uniquely identified by a `type` parameter and an `ID` parameter, although a rating item also requires a parameter for the rating value itself. It is assumed that an application will be able to rely on some sort of inventory system that determines a type and ID for each item. A type might be something like "shoes" or "sporting events". An ID is an identifying number, and within any single taxonomy no two items can have the same ID.

Be aware that for some personalization filtering settings, a recommendation will represent a category, such as "Drama", rather than an item, such as a specific movie title. In this case, the item type of the recommendation is "Category". Also see "Recommendation Filtering" on page 9-24.

The Oracle9*i*AS Personalization tag library provides a convenient public class to simplify the use of items and recommendations in JSP pages—the `oracle.jsp.webutil.personalization.Item` class. Use this class to access type, ID, and prediction values. See "Item Class Description" on page 9-54 for more information.

Ratings and Rankings

Items returned as recommendations include a *prediction* value, as follows:

- For a rating item, the prediction value of each item is its rating. This is a predicted measure of user interest.
- For a purchasing or *navigation* item, the prediction value indicates a relative ranking among the returned items, based on the estimated probability of user interest.

A navigation item can represent anything a Web application might consider a "hit", such as viewing a page, selecting a link, clicking a button, and so on.

About Ratings *Rating* is a quantitative measure of customer preference on a predefined scale. For movies, for example, you might adopt a five-star system where a user gives his or her favorite movie five stars, which can be thought of as a rating of 5.0. In future sessions, Oracle9*i*AS Personalization would anticipate a high level of interest in this movie for this user and other users with similar interests and backgrounds. A movie that a user likes somewhat, but not as much, might get a rating of three-and-a-half stars, or 3.5.

A definitive rating value is recorded when a user interactively rates an item on the Web site. Rating is a floating point number, to allow as much granularity as desired.

A rating that is returned by the recommendation engine API or, for JSP pages, a recommendation tag, is a predicted value, according to Oracle9*i*AS Personalization algorithms.

In an Oracle9*i*AS Personalization rating system, the boundaries are configurable—such as 0.0 to 5.0 in the preceding example. This is specified in the `MTR.MTR_BIN_BOUNDARY` table of the mining table repository.

About Rankings *Ranking* is a whole number indicating the relative rank of an item among a group of items. The items are sorted according to the estimated probabilities of being purchased (for commodities to purchase) or being picked (for URL links to visit) by the user. The probability is calculated using the data mining model and a customer's profile data.

As an example, presume three items—item A, item B, and item C—are returned as recommendations. If A has a 0.9 probability of user interest, B has a 0.55 probability, and C has a 0.83 probability, then A would have a ranking of 1, C would be ranked 2, and B would be ranked 3.

The ranking of an item is relative and dynamic—relative because ranking is meaningful only for a number of items compared to each other and sorted in a certain order; dynamic because ranking of the same item may change for different customers or when ranked against different items.

Stateful Versus Stateless Recommendation Engine Sessions

Web applications can be either stateful or stateless—that is, an application may choose to maintain a user session and user-specific information on the server between requests, or it may not. The recommendation engine API and tag library are designed to handle both situations. Although there are obvious benefits to maintaining user information on the server between requests, there are also high-volume sites that rely on stateless applications for better throughput.

Note, however, that the recommendation engine will always track open user sessions in the recommendation engine database schema, regardless of the session behavior of the Web application.

The recommendation engine tracks a user session by its user ID. Therefore, care must be taken in assigning temporary user IDs to anonymous visitors. If the same ID is used for all anonymous visitors, and their behavior is being tracked, then data collected from all such visitors will be attributed to a single recommendation engine session, and behavior of any one anonymous visitor would influence recommendations to the others. You can avoid this problem by assigning each anonymous visitor a temporary ID that is unique within the recommendation engine.

Note: One of the advantages of the tag library, compared to using the recommendation engine Java API directly, is that tracking of recommendation engine sessions in a stateless application is managed automatically. You must arrange this mapping yourself if you use the API directly.

Be aware, however, that recommendation engine session tracking through the tag library requires the client, presumably a browser, to support and accept cookies. If this is not always guaranteed, then you must declare your application as stateful.

Requests for Recommendations

After a recommendation engine session is established and populated with data, an application can request recommendations from it. Oracle9*i*AS Personalization returns the appropriate recommendations to the calling application, and the application decides what to pass to the user and how to pass it.

In JSP pages, an application can request recommendations through one of several "recommendation tags". The recommendation engine returns a set of suggested items according to user data, with respect to tuning and filtering settings. In using the Oracle9*i*AS Personalization tag library, you can specify tuning and filtering settings through tag attributes or in a configuration file.

A set of recommendations is generated in the recommendation engine database schema through a JDBC call. The time spent in the call may vary. This depends on the criteria, how many data records must be processed, and such factors as the size of the rules table, the size of the user profile data, and specifics of the recommendation request. Recommendations will be chosen according to the personalization model, which is deployed into the recommendation engine that the application is connected to. When you use Oracle9*i*AS Personalization tags, use attributes of the `startRESession` tag to specify the recommendation engine to use.

For *cross-sell* recommendations, the application must pass in as input one or more purchasing or navigation items of past user interest. The cross-sell recommendations will be based on the item or items passed in, and perhaps on past or current user data as well.

Recommendation items are returned in an array, with a prediction value for each recommendation—either a rating or a ranking, as described in "Ratings and Rankings" on page 9-9—and an *interest dimension* value for the array as a whole. For items returned as recommendations, the interest dimension indicates how the items will be of interest to the user—as purchasing items, navigation items, or rating items.

The recommendation engine API allows filtering of recommendations before they are returned, based on the taxonomy.

Overview of Personalization Tag Functionality

This section provides an overview of the features and functionality of the Oracle9*i*AS Personalization tag library. For descriptions and syntax of the individual tags, see "Personalization Tag and Class Descriptions" on page 9-26.

Discussion of the functionality of the tag library is organized as follows:

- Recommendation Engine Session Management
- Use of Items in Personalization Tags
- Mode of Use for Item Recording Tags
- Use of Tuning, Filtering, and Sorting for Recommendation and Evaluation Tags

Note: The Oracle9*i*AS Personalization tag library does not assume that HTML will be the only output format. Other formats, such as XML and JavaScript, are supported as well.

Recommendation Engine Session Management

The actions of creating and closing a recommendation engine session are handled through the `startRESession` and `endRESession` tags. For a JSP page using Oracle9*i*AS Personalization, you must ensure that at least one `startRESession` tag is executed, and that it is the first Oracle9*i*AS Personalization tag encountered for the particular recommendation engine session.

The Oracle9*i*AS Personalization tag library can support either stateful applications, which maintain state information through HTTP session objects, or stateless applications, which do not. You can use the `session` attribute of `startRESession` to specify which mode to use—a "`true`" setting to allow the tag library to use HTTP session objects, or a "`false`" setting if you do not want the tags to participate in HTTP sessions.

Setting the `session` attribute of a `startRESession` tag to "`true`" produces effects similar to those of setting `session` to "`true`" in a JSP `page` directive. The difference is that by setting the attribute to "`true`" in a `startRESession` tag, you are affecting not only the page containing the tag, but also any other pages that contain personalization tags that execute within the same recommendation engine session.

After the `startRESession` tag is executed, the personalization tags maintain the relationship of the Web client to the recommendation engine database session so that subsequent personalization tags apply to the same user, as appropriate.

Starting a Recommendation Engine Session

The `startRESession` tag takes the recommendation engine name and other information from some combination of tag attribute settings and `personalization.xml` configuration file settings.

A `startRESession` tag will result in no operation if the recommendation engine session was previously started for the same Web client, with no `endRESession` tag executed in between. This is for convenience; it allows flexibility regarding the order in which JSP pages are executed. You can place `startRESession` tags in multiple pages of an application without negative consequences.

See "Personalization startRESession Tag" on page 9-27 for detailed information about this tag. Also see "Personalization Tag Library Configuration Files" on page 9-57.

Using a Stateful Application

For a stateful application, which uses HTTP sessions, session information is maintained in the JSP implicit `session` object, a standard `HttpSession` instance.

When the `startRESession` tag is encountered, if its `session` attribute is set to "`true`" (the default), then the session object is created automatically if it does not already exist.

Using a Stateless Application

For a stateless application, the tag library will maintain internal session tracking through the use of cookies. Therefore, be aware that if you want to use a stateless application, personalization tags will work only if the client browser accepts cookies. If that is not the case, either because the browser chooses to decline cookies or due to lack of capability (such as for wireless protocol browsers), then stateful functionality is required (`session="true"` for the `startRESession` tag).

Ending a Recommendation Engine Session

When a stateful application no longer needs a given recommendation engine session, you can use the `endRESession` tag. As with `startRESession` tags, repeated executions of `endRESession` tags result in no further operations, so you

can place them in multiple pages of your application without negative consequences.

The `endRESession` tag has no effect in stateless applications.

Using `endRESession` tags in stateful applications is sometimes optional, but is necessary in the following circumstances:

- if the application intends to subsequently start a new recommendation engine session with a different recommendation engine user ID from the same browser or within the same HTTP session
- to connect to a different recommendation engine from the same browser or within the same HTTP session

In these cases, the `endRESession` tag must be executed before the next `startRESession` tag.

Use of `endRESession` tags is also advisable if an application stops using its Oracle9*i*AS Personalization tags significantly before the HTTP session is over, so that recommendation engine resources can be released.

See "Personalization endRESession Tag" on page 9-30 for detailed information about this tag.

Note: If `endRESession` is not used in a stateful application, the underlying recommendation engine session will be closed automatically when the HTTP session goes out of scope. In a stateless application, the underlying recommendation engine session is allowed to time out.

Use of Items in Personalization Tags

The Oracle9*i*AS Personalization tag library provides a number of tags for item manipulation—tags to record user behavior information, tags to remove user behavior information that was previously recorded, tags for outputting items as recommendations, and a tag for inputting a specific set of items to be evaluated and rated or ranked.

This section covers the following topics:

- Specification of Input Items
- Inputting Item Arrays
- Demographic Items

Overview of Item Recording and Removal Tags

The following tags are for recording data items into the recommendation engine session cache, or for removing items that were recorded earlier in the session:

- `recordNavigation` and `removeNavigationRecord`
- `recordPurchase` and `removePurchaseRecord`
- `recordRating` and `removeRatingRecord`
- `recordDemographic` and `removeDemographicRecord`

> **Note:** During the session, recorded items are periodically flushed to the recommendation engine. Removing an item after that point still works, but requires a database round-trip. See related information about `REFlushInterval` in "Personalization startRESession Tag" on page 9-27.

To record or remove a purchasing, navigation, or rating item, you must specify the item to record or remove by providing either a type and ID (and a value, for a rating item), or an item array and an index into that array. See "Specification of Input Items" on page 9-18 for more information. To record or remove a demographic item, which implicitly applies to the current user, you must specify the demographic type, such as AGE, and a value, such as 44. See "Demographic Items" on page 9-20.

There is typically little need to use the `remove`*`XXX`*`Record` tags. If you place your `record`*`XXX`* tags in "receiving pages", there should be no need to use `removePurchaseRecord` or `removeNavigationRecord` tags. Using `removeRatingRecord` and `removeDemographicRecord` tags would be necessary only in situations where users changed their minds after their initial input had been recorded. See "Mode of Use for Item Recording Tags" on page 9-21 for related information.

For detailed tag information, see "Item Recording and Removal Tag Descriptions" on page 9-46.

Overview of Recommendation and Evaluation Tags

The following tags return an array of items as recommendations:

- `selectFromHotPicks`
- `getRecommendations`
- `getCrossSellRecommendations`
- `evaluateItems`

For the `selectFromHotPicks`, `getRecommendations`, and `getCrossSellRecommendations` tags—referred to in this document as *recommendation tags*—the array of items is a set of recommendations returned from an entire taxonomy or from *hot picks* groups within a taxonomy. The `getCrossSellRecommendations` tag must also take a set of purchasing items or navigation items as input, on which to base the recommendations (known as cross-selling).

Hot picks might be promotional items or other specially selected groups of items, and the picks to choose from can be specified through a tag attribute. See the *Oracle9iAS Personalization Administrator's Guide* for more information about hot picks.

For `evaluateItems`, you must input a particular set of items for which you want evaluations. Some or all (or in some cases, none) of the same items are then returned, either rated or ranked depending on the interest dimension. See "Ratings and Rankings" on page 9-9 for background information.

For the `getRecommendations` and `evaluateItems` tags, the results are based on the particular user. The user identity is specified through the `startRESession` tag and is implicitly applied to all subsequent personalization tags. The `getCrossSellRecommendations` tag depends on the set of input items.

More About the Recommendation Tags Following is additional information about each of the recommendation tags. For detailed tag descriptions, see "Recommendation and Evaluation Tag Descriptions" on page 9-31.

- `selectFromHotPicks`—The items returned are from a set of hot picks groups. Use the `hotPicksGroups` attribute to specify the hot picks groups to choose from. In a sense, this as a "non-personal" tag in the Oracle9*i*AS Personalization tag library, because the results do not depend on the user. It may still be useful in personalized applications, however, for displaying promotions for a first-time visitor or for a particular geographical area or interest group, for example.

- `getRecommendations`—The items returned are based on the user, but you can also specify that they must be from a set of hot picks groups specified through the `fromHotPicksGroups` attribute.
- `getCrossSellRecommendations`—The items returned are based on input items. You can also specify that the items returned must be from a set of hot picks groups specified through the `fromHotPicksGroups` attribute. The input items are assumed to be of previous interest to one user. Functionality of this tag attempts to answer the following question: Assuming that a user bought or navigated to the input items in the past, what are the most likely additional items of interest to that user in the future—additional items to purchase or navigate to (according to the interest dimension)?

Input Items For the tags that take items as input—the `getCrossSellRecommendations` and `evaluateItems` tags—you can use one or more nested `forItem` tags to specify desired items, or you can input an entire array of items through a tag attribute. For more information about inputting items, see "Specification of Input Items" on page 9-18.

Output Items For the `evaluateItems` and `getCrossSellRecommendations` tags, there is a required tag attribute to specify the name of a tag-extra-info (TEI) variable for the output array of items. For the `getRecommendations` and `selectFromHotPicks` tags, this attribute is optional—alternatively or additionally, the items are available sequentially to any `getNextItem` tags nested within the `getRecommendations` or `selectFromHotPicks` tag.

For the recommendation tags, you can use the `maxQuantity` attribute to specify the maximum number of output items. To determine the actual number of items returned, use the `length` attribute of the TEI array variable for the returned items. No separate TEI variable is provided for the array size. See the following section, "Use of Tag-Extra-Info Scripting Variables for Returned Items", for information about TEI variables.

Use of Tag-Extra-Info Scripting Variables for Returned Items

For each tag that returns an array of items, there is a *tag-extra-info* (TEI) class that provides functionality allowing you to use a scripting variable of the following array type:

```
oracle.jsp.webutil.personalization.Item[]
```

The array of items is returned in this variable. Each of these tags has a `storeResultsIn` attribute that you use to specify a variable name. You can loop

through the array in your application to display all the items, such as in an HTML table. Use the `length` attribute of the array to determine how many items were returned.

The `selectFromHotPicks`, `getRecommendations`, and `getCrossSellRecommendations` tags can also return a TEI `String` variable indicating the interest dimension for the items in the array—`NAVIGATION`, `PURCHASING`, or `RATING`. Use the `storeInterestDimensionIn` tag attribute to specify a variable name for the interest dimension.

Note: For general information about tag-extra-info classes and scripting variables, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

Specification of Input Items

There are two general situations where you must input items:

- to provide input items to a `getCrossSellRecommendations` or `evaluateItems` tag

  In addition to the `getCrossSellRecommendations` or `evaluateItems` tag, this can involve one or more nested `forItem` tags. The `forItem` tags are used to select desired input items.

- to record an item into the recommendation engine session, or, using similar syntax, to remove an item that was previously recorded

  This involves a `record`*`XXX`* or `remove`*`XXX`*`Record` tag.

You can specify items in the following general ways:

1. Specify the type and ID of each desired item, and also the rating value for a rating item. Or, for a demographic item, specify the type and value.
2. Supply an item array, and the index into the array for each desired item.
3. Supply an entire array of items (not relevant for `record`*`XXX`* and `remove`*`XXX`*`Record` tags).

For scenarios #2 and #3, see the following section, "Inputting Item Arrays", for more information.

You can input one or more items into a `getCrossSellRecommendations` or `evaluateItems` tag as follows:

- Nest one or more `forItem` tags inside the tag, using the `type` and `ID` attributes of each `forItem` tag to specify a desired item (scenario #1 above).

or:

- Nest one or more `forItem` tags inside the tag, using the `itemList` attribute of each `forItem` tag to specify an item array, and using the `index` attribute to specify a desired element of the array (scenario #2).

or:

- Specify an `Item[]` array through the `inputItemList` attribute of the tag (scenario #3). The entire array is taken as input.

Note that you can use more than one of these procedures simultaneously. The `getCrossSellRecommendations` and `evaluateItems` tags can take input from multiple sources.

You can specify an item for a `record`*`XXX`* or `remove`*`XXX`*`Record` tag as follows:

- Use the `type` and `ID` attributes of the tag, and the `value` attribute for `recordRating` or `removeRatingRecord`, to specify the item (scenario #1 above). Or, for `recordDemographic` or `removeDemographicRecord`, use the `type` and `value` attributes.

or:

- Use the `itemList` attribute of the tag to specify an item array, and the `index` attribute of the tag to specify the desired element of the array (scenario #2).

Inputting Item Arrays

For situations where you input an array of `Item[]` objects to a tag, you must specify the array through a JSP expression. This may apply to any of the following tags:

- `getCrossSellRecommendations` or `evaluateItems`, when you use the `inputItemList` attribute to input an entire array
- `forItem` (inside `getCrossSellRecommendations` or `evaluateItems`), `recordPurchase`, `recordNavigation`, `recordRating`, `removePurchaseRecord`, `removeNavigationRecord`, or `removeRatingRecord`, when you use the `itemList` and `index` attributes to input an array and specify one element of it for use

You can supply the array in the following ways:

- Create it in a scriptlet then specify it through a JSP expression:

```
<% Item[] myList = newItem[] {newItem("shoes", 1)}; %>
<op:evaluateItems inputItemList="<%=myList %> .../>
```

- Supply it by using a TEI variable that contains the output from a recommendation tag:

```
<op:getRecommendations storeResultsIn="myRecs" .../>
<!-- First tag is closed, but TEI variable is still in scope.
Later use it in second tag. -->
<op:getCrossSellRecommendations inputItemList="<%=myRecs %>" />
```

Note: See "Recommendation and Evaluation Tag Descriptions" on page 9-31 for detailed syntax information for the tags shown here.

Demographic Items

Demographic data items, consisting of background information about the user such as gender and age, are used in only the `recordDemographic` and `removeDemographicRecord` tags. Because they do not contain purchasing, navigation, or rating information, they cannot be returned by a recommendation tag or input to a `getCrossSellRecommendations` or `evaluateItems` tag.

Demographic items, instead of being identified by `type` and `ID` as for purchasing and navigation items, are identified by `type` and `value`. These are the only two attributes for the `recordDemographic` and `removeDemographicRecord` tags. There are several pre-defined types, which exist as columns in the mining table repository in the `MTR.MTR_CUSTOMERS` table:

- `GENDER`
- `AGE`
- `MARITAL_STATUS`
- `PERSONAL_INCOME`
- `HOUSEHOLD_INCOME`
- `IS_HEAD_OF_HOUSEHOLD`
- `HOUSEHOLD_SIZE`

- RENT_OWN_INDICATOR

There are also 50 customizable columns: ATTRIBUTE1 through ATTRIBUTE50.

To use a customizable type, you must do the following:

1. Map the ATTRIBUTEx column to an existing enterprise database, thus defining what the attribute is.
2. Define the corresponding value boundaries in the MTR.MTR_BIN_BOUNDARIES table.

Mode of Use for Item Recording Tags

In Oracle9*i*AS release 2, you can use one mode of operation for item recording tags: *receiving mode*. In this mode, when users select something—such as an item to purchase or a URL to navigate to—the page they are sent to, referred to as the *receiving page*, contains the record*XXX* tag to record the item.

As a general example, assume that a page uses a getRecommendations tag to generate a list of recommendations that are displayed in a sequence. Each recommended item has a **Details** link that a user can select to get more information, and a **Purchase** link that a user can select to purchase the item. You can place a recordNavigation tag in the page the user goes to by selecting **Details**; and you can place a recordPurchase tag in the page the user goes to by selecting **Purchase** (a purchase confirmation page, for example). In either case, the type and ID of the item are likely already known on the receiving pages, which are devoted specifically to that item.

Similarly, you might place a recordDemographic tag in a JSP page where users enter demographic information. For example, there might be a page that allows users to enter marital status, age, and personal income. Once a user enters the information—suppose single, age 44, with an annual salary of $50,000—the target of the action behind the HTML form is an advertising page tailored to that profile. This page would have recordDemographic tags for types MARITAL_STATUS, AGE, and PERSONAL_INCOME. You can use multiple recordDemographic tags in a single page.

It is typical to identify items by specifying the appropriate attributes, such as type and ID for purchasing and navigation items. Alternatively, you can use a previously created item list, and an index value into that list, to specify an item. The application can copy an item list array object into a session or request object and also pass the index as a parameter to the receiving page. On the receiving page, the item list can be retrieved from the session or request object and passed to the record*XXX* tag along with the index. This approach has at least one advantage,

in that the sending page or pages can collect more than one index before invoking the receiving page, then simultaneously record numerous items from the same item list.

Use of Tuning, Filtering, and Sorting for Recommendation and Evaluation Tags

As summarized earlier, the `selectFromHotPicks`, `getRecommendations`, `getCrossSellRecommendations`, and `evaluateItems` tags all return an array of items. This section provides information about tuning and filtering settings you can use to more carefully tailor the recommendations that are returned, and a setting to sort the recommendations. Filtering settings do not apply to the `evaluateItems` tag, however, because the items output are always from the set of items input.

This section is organized as follows:

- Tuning Settings
- Recommendation Filtering
- Sorting Order

Tuning Settings

Several *tuning settings* determine some of the qualifications and logic used by the recommendation engine in returning recommendations. There must be a value for each setting, determinable in one of the ways described here.

You can specify these settings through the `tuning`*XXX* attributes of the `selectFromHotPicks`, `getRecommendations`, `getCrossSellRecommendations`, and `evaluateItems` tags, as summarized in Table 9–1. Alternatively, you can use the `tuningName` attribute to get the settings from the specified `<Tuning>` element in either the application-level `personalization.xml` file (first choice) or the server-wide `personalization.xml` file. Also see "Personalization Tag Library Configuration Files" on page 9-57.

If there are no attribute settings or is no `<Tuning>` element, default values will be chosen according to the following steps, in order:

1. According to a `<DefaultTuning>` element in the application-level `personalization.xml` file.
2. According to a `<DefaultTuning>` element in the server-wide `personalization.xml` file.

3. According to the following hardcoded settings:

```
tuningDataSource="ALL"
tuningInterestDimension="NAVIGATION"
tuningPersonalizationIndex="MEDIUM"
tuningProfileDataBalance="BALANCED"
tuningProfileUsage="INCLUDE"
```

> **Note:** To use the hardcoded defaults, do not use any of the `tuning`*XXX* attribute settings. If some tuning settings are defined in a tag, then none of the hardcoded values will be used. In this case, if any setting cannot be found in a tag attribute or `personalization.xml` file, an exception will be thrown.

Table 9–1 Tuning Settings for Requesting Recommendations

Attribute	Description	Settings

tuningDataSource	Specify the kind of past user data to be considered in making recommendations. (Do not confuse this kind of data source with the data source concept in the J2EE platform model.)	`ALL`
		`NAVIGATION`
		`PURCHASE`
		`RATING`
		`DEMOGRAPHIC`

tuningInterestDimension	Specify the kind of recommendation to be returned.	`RATING`
		`PURCHASING`
		`NAVIGATION`

tuningPersonalizationIndex	Choose how generalized or how personalized the recommendation algorithm should be.	`LOW`
		`MEDIUM`
		`HIGH`

tuningProfileDataBalance	Choose whether to stress historical data, current session data, or both in making recommendations.	`HISTORY`
		`CURRENT`
		`BALANCED`

tuningProfileUsage	Choose whether to use data in the user's demographic profile.	`INCLUDE` `EXCLUDE`

For more information about tuning settings, refer to the *Oracle9iAS Personalization Administrator's Guide.*

Recommendation Filtering

In addition to tuning settings, there are *filtering settings* that you can specify for a recommendations request. There must be a value for each setting, determinable in one of the ways described here.

You can specify these settings through the `filtering`*XXX* attributes of the `getRecommendations`, `getCrossSellRecommendations`, and `selectFromHotPicks` tags. (Filtering is not relevant to the `evaluateItems` tag.) Alternatively, you can use the `filteringName` attribute to get the settings from the specified `<Filtering>` element in either the application-level `personalization.xml` file (first choice) or the server-wide `personalization.xml` file. Also see "Personalization Tag Library Configuration Files" on page 9-57.

If there are no attribute settings or is no `<Filtering>` element, default values will be chosen from the `<DefaultFiltering>` element in either the application-level `personalization.xml` file (first choice), or the server-wide `personalization.xml` file.

These are the filtering parameters:

- `filteringTaxonomyID`—This is a Java string representing an integer, where the integer is the ID of an item taxonomy in the Oracle9*i*AS Personalization environment.
- `filteringMethod`—This is one of `ALL_ITEMS`, `INCLUDE_ITEMS`, `EXCLUDE_ITEMS`, `SUBTREE_ITEMS`, `ALL_CATEGORIES`, `INCLUDE_CATEGORIES`, `EXCLUDE_CATEGORIES`, `SUBTREE_CATEGORIES`, and `CATEGORY_LEVEL`. Table 9–2 summarizes the meanings. These methods always apply to the taxonomy specified through the `filteringTaxonomyID` value.

  For the `getCrossSellRecommendations` tag, only the `ALL_ITEMS`, `INCLUDE_ITEMS`, `EXCLUDE_ITEMS`, and `SUBTREE_ITEMS` settings are supported.
- `filteringCategories`—This is a Java string of integer IDs, delimited by a single plus sign (+) after each ID, identifying existing item categories in the given taxonomy. Categories are defined in the mining table repository, in the `MTR.MTR_CATEGORY` table.

Note: Do *not* provide a `filteringCategories` setting when `filteringMethod` is `ALL_ITEMS` or `ALL_CATEGORIES`.

Table 9–2 Filtering Methods for Requesting Recommendations

Filtering Method	Description
ALL_ITEMS	Recommend items from all leaves in the taxonomy.
INCLUDE_ITEMS	Recommend items that belong to the categories specified in filteringCategories.
EXCLUDE_ITEMS	Recommend items in the taxonomy that do *not* belong to the categories specified in filteringCategories.
SUBTREE_ITEMS	Recommend items that belong to the subtrees of the categories specified in filteringCategories.
ALL_CATEGORIES	Recommend all categories in the taxonomy.
INCLUDE_CATEGORIES	Recommend categories specified in filteringCategories.
EXCLUDE_CATEGORIES	Recommend categories in the taxonomy that are *not* specified in filteringCategories.
SUBTREE_CATEGORIES	Recommend categories from the subtrees of the categories specified in filteringCategories.
CATEGORY_LEVEL	Recommend categories of the same level as the categories specified in filteringCategories.

For any of the *XXX*_CATEGORIES settings, recommendations are returned in the form of categories, such as "drama", rather than specific items, such as a particular movie title. The item type is Category in this case, and categories must first be defined in the mining table repository.

For more information, refer to the *Oracle9iAS Personalization Programmer's Guide*.

Sorting Order

You can sort returned items according to the prediction field of each item, which is either a rating or a ranking. See "Ratings and Rankings" on page 9-9 for information about how to use this field.

Use the sortOrder attribute of the selectFromHotPicks, getRecommendations, getCrossSellRecommendations, or evaluateItems tag to specify a sorting order of ASCEND, DESCEND, or NONE (default). Ascending order lists the best match first, and descending order does the opposite. An ascending order of five ranked items would be 1, 2, 3, 4, then 5, because 1 is the highest rank. An ascending order of five rated items would be something like 4.5, 3.9, 2.5, 2.2, then 1.8, because a higher number means a higher rating.

Personalization Tag and Class Descriptions

This section provides detailed descriptions of syntax and usage for the Oracle9*i*AS Personalization tags and the `Item` public class, concluding with a discussion of tag limitations. It is organized as follows:

To use the Oracle9*i*AS Personalization tag library, verify that the file `ojsputil.jar` is installed and in your classpath. This file is provided with OC4J. You will also need the classes for the recommendation engine API, which are in the `oreapi-rt.jar` file. If you install Oracle9*i* Application Server with the "Business Intelligence" option, this file will be installed in the `[SRCHOME]/dmt/jlib` directory. Copy it to a location that is accessible to your application.

The tag library descriptor file, `personalization.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

Notes:

- The prefix "op:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.
- Where there is a fixed number of supported attribute settings, such as "`true`" or "`false`", entries are *not* case-sensitive.

Use of some of the tag attributes described here requires some general knowledge of the Oracle9*i*AS Personalization and recommendation engine implementations.

Where information here is incomplete, see the *Oracle9iAS Personalization Administrator's Guide* or the *Oracle9iAS Personalization Programmer's Guide*.

Session Management Tag Descriptions

This section documents the following tags for starting, ending, and managing recommendation engine sessions:

- Personalization startRESession Tag
- Personalization endRESession Tag
- Personalization setVisitorToCustomer Tag

Personalization startRESession Tag

This section provides syntax and attribute descriptions for the `startRESession` tag, which you use to start a recommendation engine session. Also see "Recommendation Engine Session Management" on page 9-12 for related information.

The `startRESession` tag must be executed before any other Oracle9*i*AS Personalization tag that executes within the same recommendation engine session.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:startRESession REName = "recommendation_engine_connection_name"
                  [ REURL = "rec_engine_database_connection_URL" ]
                  [ RESchema = "rec_engine_schema_name" ]
                  [ REPassword = "rec_engine_schema_password" ]
                  [ RECacheSize = "kilobytes_of_cache" ]
                  [ REFlushInterval = "milliseconds_to_flush" ]
                  [ session = "true" | "false" ]
                  [ userType = "visitor" | "customer" ]
                  [ UserID = "user_ID_for_site_login" ]
                  [ storeUserIDIn = "variable_name" ]
                  [ disableRecording = "true" | "false" ] />
```

The `startRESession` tag has no body.

Attribute Usage Notes

- For the `startRESession` tag to work, `REName` is a required attribute, and you must define `REURL`, `RESchema`, and `REPassword` through tag attributes or through one of the `personalization.xml` files. (Also see "Personalization Tag Library Configuration Files" on page 9-57.)
- `REName` specifies the name of a recommendation engine connection in a recommendation engine farm. Multiple user sessions should share the same connection whenever possible, for greater efficiency. To accomplish this, use the same `REName` value whenever you want to use the same connection. After the recommendation engine connection is created, it is cached, using the `REName` value as a key.

  If `REURL`, `RESchema`, or `REPassword` is not set through attributes of the `startRESession` tag that first establishes a connection, then the settings of all three must come from a `personalization.xml` file with an `<RE>` element whose `Name` attribute matches the `REName` value of the `startRESession` tag. In this case, you must also set `RECacheSize` and `REFlushInterval` in the `<RE>` element if you want nondefault values. In this scenario, the application-wide `personalization.xml` is searched first; the server-wide `personalization.xml` is searched only if the application-wide file did not have an `<RE>` element with the `REName` value as its name.

  Note: When `REName` matches the name of an existing connection, any settings for `REURL`, `RESchema`, `REPassword`, `RECacheSize`, and `REFlushInterval` are superfluous and therefore ignored.

- You can use the `REName` attribute together with `<RE>` element settings to facilitate load-balancing among recommendation engines in a farm. Each `<RE>` element points to a different recommendation engine in the farm. The JSP page can rotate among different recommendation engines in the farm by assigning different values to the `REName` attribute of different `startRESession` tags, according to some load-balancing heuristic.
- Although default values are provided for `RECacheSize` and `REFlushInterval`, these are intended only to get you started. Once you have experience in running the application, you can tune these values according to Web site conditions. The settings of `RECacheSize` and `REFlushInterval` should be in coordination with each other, and according to your estimate of how quickly items might be added to the recommendation engine session cache

as the result of user actions. The default cache size is 3234 KB, the maximum possible, which is enough space to store approximately 4800 items. With the default flush interval of 60 seconds (60000 milliseconds), that allows a cache incoming rate of 80 items per second. If you increase the flush interval to 120 seconds, you can support only 40 new items being added per second. On the other hand, if you reduce the flush interval to 30 seconds, you can support a cache incoming rate of 160 items per second. A disadvantage in shortening the flush interval, however, is that removing an item (through a `remove`*`XXX`*`Record` tag) after it has been flushed requires a database round-trip.

Be aware that all sessions sharing the same recommendation engine connection within the same JVM are also sharing the same session cache. The cache incoming rate is cumulative across all such sessions.

Attributes

- `REName` (required)—Use this to specify the name of a recommendation engine connection in a recommendation engine farm. Under some circumstances, it must also match the name of an `<RE>` element in `personalization.xml` so that settings can be retrieved from there, as noted in the preceding attribute usage notes. See "Personalization Tag Library Configuration Files" on page 9-57 for related information.
- `REURL`—This is the JDBC connection string for the recommendation engine database.
- `RESchema`—This is the name of the recommendation engine database schema.
- `REPassword`—This is the password corresponding to the `RESchema` name.
- `RECacheSize`—Use this to specify the size of the recommendation engine session cache, in kilobytes. The default is 3234 KB. This should be adjusted in coordination with `REFlushInterval`, as described in the preceding attribute usage notes.
- `REFlushInterval`—Use this to specify how often the data in the recommendation engine session cache is flushed into the recommendation engine schema. The unit is milliseconds, with a default of 60000 (1 minute). This should be adjusted in coordination with `RECacheSize`, as described in the preceding attribute usage notes.
- `session`—Use a "`true`" setting (default) to specify that you want your Oracle9*i*AS Personalization JSP pages to act in a stateful manner, through the

use of HTTP session objects. Use a "`false`" setting for pages to act in a stateless manner, using cookies instead.

- `userType`—This indicates whether the Web site user is an anonymous "`visitor`" (default) or a registered "`customer`".
- `userID`—This is the user name for the Web site user. If not provided, such as for an anonymous visitor, the ID is generated automatically by the tag handler.
- `storeUserIDIn`—If you want to store the `userID` value for later use, `storeUserIDIn` can specify the name of a TEI `String` variable in which to store it. This attribute is useful for automatically generated user IDs.
- `disableRecording`—Use a "`true`" setting to disable the actions of any `record`*XXX* tags. This is to allow for the possibility, for example, of a Web site that permits users to specify that their activities should not be recorded. It is also a way to improve site performance during peak hours. This attribute can be set at request-time, based on the current user ID, for example. This permits recording to be disabled for appropriate users only, or at appropriate times, without changing your JSP code. The default setting is "`false`".

Personalization endRESession Tag

Use this tag to explicitly end a recommendation engine session in a stateful application. This is usually optional, but is required under some circumstances—see "Ending a Recommendation Engine Session" on page 9-13. It is also advisable to use this tag in a stateful application if application logic determines that the recommendation engine session is no longer required—this will free unneeded resources.

For situations where you do *not* use `endRESession`, note the following behavior:

- If you started the recommendation engine session with the `session` attribute of the `startRESession` tag set to "`true`", then the recommendation engine session will be closed implicitly at the end of the HTTP session.
- If you started the recommendation engine session with `session` set to "`false`", then the recommendation engine session will be allowed to time out once it has been inactive for a sufficient period of time. The timeout interval is specified as a configuration parameter of the recommendation engine schema. The `endRESession` tag has no effect.

Syntax

```
<op:endRESession />
```

The `endRESession` tag has no attributes and no body.

Personalization setVisitorToCustomer Tag

Use this tag for situations where an anonymous visitor creates a registered customer account. Upon execution of this tag, the existing recommendation engine session is converted from a visitor session to a customer session. Previous data gathered in the session will be retained. This tag does not actually create the new customer, nor does it execute a new login. It only converts the ongoing recommendation engine session.

The `customerID` value is a request-time attribute and must be provided by the application.

Syntax

```
<op:setVisitorToCustomer customerID = "<%=registered_customer_name%>" />
```

The `setVisitorToCustomer` tag has no body.

Attributes

- `customerID` (required)—The application provides the ID for the newly registered customer.

Recommendation and Evaluation Tag Descriptions

This section provides detailed descriptions of the recommendation tags, the evaluation tag, and related subtags. The following tags are covered:

- Personalization getRecommendations Tag
- Personalization getCrossSellRecommendations Tag
- Personalization selectFromHotPicks Tag
- Personalization evaluateItems Tag
- Personalization forItem Tag
- Personalization getNextItem Tag

Also see "Overview of Recommendation and Evaluation Tags" on page 9-16.

Personalization getRecommendations Tag

Use this tag to request a set of recommendations for purchasing, navigation, or ratings. Items from a particular taxonomy are considered, with tuning and filtering as specified. Recommendations are returned in an array of the following type:

`oracle.jsp.webutil.personalization.Item[]`

Although other tags, such as `getCrossSellRecommendations` and `evaluateItems`, require items to be input for use as a basis for recommendations, the `getRecommendations` tag does not. Recommendations are based on user identity and profile (user session and historical data), not on specific items.

The resulting recommendations can optionally be stored in a TEI variable of type `Item[]`, with the variable name specified in the `storeResultsIn` attribute of the tag. The recommendations are also available implicitly within the `getRecommendations` tag. You can optionally use a tag body with nested `getNextItem` tags for any desired processing of the items. See "Personalization getNextItem Tag" on page 9-44.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:getRecommendations
  [ from = "top" | "bottom" ]
  [ fromHotPicksGroups = "string_of_Hot_Picks_group_numbers" ]
  [ storeResultsIn = "TEI_variable_name" ]
  [ storeInterestDimensionIn = "TEI_variable_name" ]
  [ maxQuantity = "integer_value" ]
  [ tuningName = "name_from_config_file_Tuning_element" ]
  [ tuningDataSource = "ALL"|"NAVIGATION"|"PURCHASE"|"RATING"|"DEMOGRAPHIC" ]
  [ tuningInterestDimension = "NAVIGATION"|"PURCHASING"|"RATING" ]
  [ tuningPersonalizationIndex = "LOW"|"MEDIUM"|"HIGH" ]
  [ tuningProfileDataBalance = "HISTORY"|"CURRENT"|"BALANCED" ]
  [ tuningProfileUsage = "INCLUDE"|"EXCLUDE" ]
  [ filteringName = "name_from_config_file_Filtering_element" ]
  [ filteringTaxonomyID = "integer_value" ]
  [ filteringMethod = "ALL_ITEMS"|"EXCLUDE_ITEMS"|"INCLUDE_ITEMS"|
            "SUBTREE_ITEMS"|"ALL_CATEGORIES"|"INCLUDE_CATEGORIES"|
            "EXCLUDE_CATEGORIES"|"SUBTREE_CATEGORIES"|CATEGORY_LEVEL" ]
  [ filteringCategories = "string_of_integers" ]
  [ sortOrder = "ASCEND"|"DESCEND"|"NONE" ] >
```

```
...

</op:getRecommendations>
```

Attribute Usage Notes Be aware of the following:

- You must specify either `from` or `fromHotPicksGroups`.
- Access the output items either through the `storeResultsIn` attribute, or through a tag body with nested `getNextItem` tags, or optionally both.
- Specify `tuningName`, corresponding to the name of a `<Tuning>` element in `personalization.xml`, or specify individual tuning settings through the `tuning`*XXX* attributes. If you do neither, see "Tuning Settings" on page 9-22 for information about how default values are chosen. Also see "Personalization Tag Library Configuration Files" on page 9-57.
- Specify `filteringName`, corresponding to the name of a `<Filtering>` element in `personalization.xml`, or specify individual filtering settings through the `filtering`*XXX* attributes. If you do neither, see "Recommendation Filtering" on page 9-24 for information about how default values are chosen.
- A `filteringCategories` setting is required, unless `filteringMethods` is set to `ALL_ITEMS` or `ALL_CATEGORIES`. These settings can be through either the tag attributes or `personalization.xml`.
- The *XXX*`_CATEGORIES` filtering methods return categories, as defined in the mining table repository, rather than specific items.

Attributes

- `from`—Use this if you want items to be selected from the entire taxonomy of items. A "`top`" setting, which is the default and is typical, displays the N (or less) most desirable items, where N is the maximum number of recommendations to display (`maxQuantity`). A "`bottom`" setting displays the N (or less) least desirable items. This is useful, for example, if Product Management wants to know which items are least favored by customers.
- `fromHotPicksGroups`—Use this if you want items to be selected from one or more hot picks groups. The application must determine a series of hot picks group ID numbers, from the same recommendation engine that was specified in the `startRESession` tag. In the `fromHotPicksGroups` attribute, you must list the group ID numbers in a string, delimited by plus signs (+), such as "`10+20+30`".

- storeResultsIn—Optionally specify the name of a TEI variable of type Item[] in which to store the resulting recommendations. (This is a required attribute for getCrossSellRecommendations, but not for getRecommendations.) If a variable name is provided, the scope of the variable is AT_BEGIN—available from the start-tag to the end of the page. Note that the value is a variable name, not a JSP expression. You must provide the variable name for translation; this is *not* a request-time attribute.
- storeInterestDimensionIn—Optionally specify the name of a TEI string variable in which to store the interest dimension, which is either NAVIGATION, PURCHASING, or RATING. Use the Item class defined constant INT_DIM_NAVIGATION, INT_DIM_PURCHASING, or INT_DIM_RATING for comparisons. If a variable name is provided, the scope of the variable is AT_BEGIN—available from the start-tag to the end of the page. You must provide the variable name for translation; this is *not* a request-time attribute. The value returned will be the same as the tuningInterestDimension setting used in the tag.
- maxQuantity—Use this if you want to specify a maximum number of recommendations that can be returned. This is optional if there is a general default specified in the <RecommendationSettings> element of the application personalization.xml file or the server-wide personalizaton.xml file. Also see "Personalization Tag Library Configuration Files" on page 9-57.
- tuningName—Use this to specify the name of a <Tuning> element in personalization.xml, so that tuning settings can be retrieved from there. Alternatively, use the individual tuning*XXX* attributes.
- tuningDataSource—See "Tuning Settings" on page 9-22.
- tuningInterestDimension—See "Tuning Settings" on page 9-22.
- tuningPersonalizationIndex—See "Tuning Settings" on page 9-22.
- tuningProfileDataBalance—See "Tuning Settings" on page 9-22.
- tuningProfileUsage—See "Tuning Settings" on page 9-22.
- filteringName—Use this to specify the name of a <Filtering> element in personalization.xml, so that filtering settings can be retrieved from there. Alternatively, use the individual filtering*XXX* attributes.
- filteringTaxonomyID—See "Recommendation Filtering" on page 9-24.
- filteringMethod—See "Recommendation Filtering" on page 9-24.

- `filteringCategories`—See "Recommendation Filtering" on page 9-24. Integers in the string are delimited by plus signs (+), such as "`101+200+35`".
- `sortOrder`—Use this to specify whether items are sorted in ascending order ("`ASCEND`", best match first) or descending order ("`DESCEND`"). The default is neither ("`NONE`"), for no sorting requirement. See "Sorting Order" on page 9-25 for more information.

Example Following is an example of basic usage of the `getRecommendations` tag. The `storeResultsIn` attribute defines an `Item[]` array for receiving and displaying results.

```
<op:getRecommendations storeResultsIn="myRecs">
<% for(int i = 0; i< myRecs.length; i++) {
   Render(myRecs(i).getType(),myRecs(i).getID());
} %>
</op:getRecommendations>
```

Also see "Personalization getNextItem Tag" on page 9-44 for an example of a `getRecommendations` tag that uses a nested `getNextItem` tag.

Personalization getCrossSellRecommendations Tag

Like the `getRecommendations` tag, the `getCrossSellRecommendations` tag returns a set of recommendations, in an array of type `Item[]`, for purchasing, navigation, or ratings. Items from a particular taxonomy are considered, with tuning and filtering as specified.

To use `getCrossSellRecommendations`, however, you must input a set of purchasing or navigation items of past user interest that are used as a basis for the resulting recommendations. The items must all be from the same taxonomy.

You can input items through a specified item array or through a tag body with nested `forItem` tags. See "Specification of Input Items" on page 9-18 for more information. Also see "Personalization forItem Tag" on page 9-42.

The recommendations from the `getCrossSellRecommendations` tag are stored in a TEI variable of type `Item[]`, with the variable name specified in the `storeResultsIn` attribute of the tag.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:getCrossSellRecommendations
    storeResultsIn = "TEI_variable_name"
  [ storeInterestDimensionIn = "TEI_variable_name" ]
  [ fromHotPicksGroups = "string_of_Hot_Picks_group_numbers" ]
  [ inputItemList = "item_array_expression" ]
  [ maxQuantity = "integer_value" ]
  [ tuningName = "name_from_config_file_Tuning_element" ]
  [ tuningDataSource = "ALL"|"NAVIGATION"|"PURCHASE"|"RATING"|"DEMOGRAPHIC" ]
  [ tuningInterestDimension = "NAVIGATION"|"PURCHASING"|"RATING" ]
  [ tuningPersonalizationIndex = "LOW"|"MEDIUM"|"HIGH" ]
  [ tuningProfileDataBalance = "HISTORY"|"CURRENT"|"BALANCED" ]
  [ tuningProfileUsage = "INCLUDE"|"EXCLUDE" ]
  [ filteringName = "name_from_config_file_Filtering_element" ]
  [ filteringTaxonomyID = "integer_value" ]
  [ filteringMethod = "ALL_ITEMS"|"EXCLUDE_ITEMS"|"INCLUDE_ITEMS"|
                      "SUBTREE_ITEMS" ]
  [ filteringCategories = "string_of_integers" ]
  [ sortOrder = "ASCEND"|"DESCEND"|"NONE" ] >

...

</op:getCrossSellRecommendations>
```

Attribute Usage Notes Be aware of the following:

- Inputting items requires either the `inputItemList` attribute, or a body with nested `forItem` tags, or optionally both. If you use both mechanisms, then the `forItem` tags will be executed first and the indicated items will be placed in an item list. Then the `inputItemList` entries are considered and appended to the list.
- Unlike for the `getRecommendations` tag, `storeResultsIn` is a required attribute for the `getCrossSellRecommendations` tag—you must specify the name of a TEI variable of type `Item[]` for storage of the resulting recommendations.
- Specify `tuningName`, corresponding to the name of a `<Tuning>` element in `personalization.xml`, or specify individual tuning settings through the `tuning`*XXX* attributes. If you do neither, see "Tuning Settings" on page 9-22 for information about how default values are chosen. Also see "Personalization Tag Library Configuration Files" on page 9-57.

- If the `tuningInterestDimension` setting is not the same as the `tuningDataSource` setting, you might not get any recommendations, depending on how Oracle9*i*AS Personalization rules are set.
- Specify `filteringName`, corresponding to the name of a `<Filtering>` element in `personalization.xml`, or specify individual filtering settings through the `filtering`*XXX* attributes. If you do neither, see "Recommendation Filtering" on page 9-24 for information about how default values are chosen.
- A `filteringCategories` setting is required, unless `filteringMethods` is set to "`ALL_ITEMS`". These settings can be through either the tag attributes or `personalization.xml`.
- The `getCrossSellRecommendations` tag cannot use category-based filtering; therefore, it supports only a limited set of filtering methods—`ALL_ITEMS`, `INCLUDE_ITEMS`, `EXCLUDE_ITEMS`, and `SUBTREE_ITEMS`.

Attributes

- `inputItemList`—If you want to supply the input items through an `Item[]` array, use this attribute with a JSP expression that returns the array. The item array in the expression can come from a prior recommendation tag. See "Inputting Item Arrays" on page 9-19 for more information.

All other attributes of the `getCrossSellRecommendations` tag are used as for the `getRecommendations` tag, as described in "Personalization getRecommendations Tag" on page 9-32, except for any limitations noted in the preceding attribute usage notes, and the fact that `storeResultsIn` is a required attribute for the `getCrossSellRecommendations` tag.

For additional information about tuning, filtering, and sorting, see "Tuning Settings" on page 9-22, "Recommendation Filtering" on page 9-24, and "Sorting Order" on page 9-25.

Example The following example uses a `getCrossSellRecommendations` tag to suggest follow-up DVD titles to a user who rented or purchased certain titles in the past.

```
<% long[] ids = ApplicationPackage.getUserHistory("Smith01");
   Item[] DVDs = new Item[ids.length];
   for(int i=0; i<ids.length; i++) {
      DVDs[i] = new Item("DVD", ids[i] );
   }
   pageContext.setAttribute("pastInterest", DVDs);
```

```
%>
<op: getCrossSellRecommendations inputItemList="pastInterest"
                                 storeResultsIn="moreDVDs"
                                 maxQuantity = "4"
                                 sortOrder="ASCEND" />
<!-- display 4 best cross-sell items -->
<h1> You will also enjoy these titles! </h1>

ApplicationSupport.displayItem(moreDVDs[1].getType(), moreDVDs[1].getID() );
ApplicationSupport.displayItem(moreDVDs[2].getType(), moreDVDs[2].getID() );
ApplicationSupport.displayItem(moreDVDs[3].getType(), moreDVDs[3].getID() );
ApplicationSupport.displayItem(moreDVDs[4].getType(), moreDVDs[4].getID() );
```

Also see "Personalization forItem Tag" on page 9-42 for an example of a `getCrossSellRecommendations` tag that uses a nested `forItem` tag.

Personalization selectFromHotPicks Tag

Use this tag to request recommendations from a set of hot picks groups only, instead of from the taxonomy as a whole, and without considering the user profile. Tuning and filtering are still applied to items in the specified groups.

Other than the fact that `selectFromHotPicks` does not consider user identity and profile, it works in essentially the same way as the `getRecommendations` tag with a specified `fromHotPicksGroups` setting. See "Personalization getRecommendations Tag" on page 9-32 for detailed information about that tag.

You can optionally store the resulting recommendations in a TEI variable of type `Item[]`, with the variable name specified in the `storeResultsIn` attribute of the tag. The recommendations are also available implicitly within the `selectFromHotPicks` tag. You can optionally use a tag body with nested `getNextItem` tags for any desired processing of the items. See "Personalization getNextItem Tag" on page 9-44.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:selectFromHotPicks
    hotPicksGroups = "string_of_Hot_Picks_group_numbers"
  [ storeResultsIn = "TEI_variable_name" ]
  [ storeInterestDimensionIn = "TEI_variable_name" ]
  [ maxQuantity = "integer_value" ]
```

```
  [ tuningName = "name_from_config_file_Tuning_element" ]
  [ tuningDataSource = "ALL"|"NAVIGATION"|"PURCHASE"|"RATING"|"DEMOGRAPHIC" ]
  [ tuningInterestDimension = "NAVIGATION"|"PURCHASING"|"RATING" ]
  [ tuningPersonalizationIndex = "LOW"|"MEDIUM"|"HIGH" ]
  [ tuningProfileDataBalance = "HISTORY"|"CURRENT"|"BALANCED" ]
  [ tuningProfileUsage = "INCLUDE"|"EXCLUDE" ]
  [ filteringName = "name_from_config_file_Filtering_element" ]
  [ filteringTaxonomyID = "integer_value" ]
  [ filteringMethod = "ALL_ITEMS"|"EXCLUDE_ITEMS"|"INCLUDE_ITEMS"|
            "SUBTREE_ITEMS"|"ALL_CATEGORIES"|"INCLUDE_CATEGORIES"|
            "EXCLUDE_CATEGORIES"|"SUBTREE_CATEGORIES"|CATEGORY_LEVEL" ]
  [ filteringCategories = "string_of_integers" ]
  [ sortOrder = "ASCEND"|"DESCEND"|"NONE" ] >

...

</op:selectFromHotPicks>
```

Attribute Usage Notes Be aware of the following:

- The `hotPicksGroups` attribute is equivalent to the `fromHotPicksGroups` attribute of the `getRecommendations` tag, but `hotPicksGroups` is required.
- Access the output items either through the `storeResultsIn` attribute, or through a tag body with nested `getNextItem` tags, or optionally both.
- Specify `tuningName`, corresponding to the name of a `<Tuning>` element in `personalization.xml`, or specify individual tuning settings through the `tuning`*XXX* attributes. If you do neither, see "Tuning Settings" on page 9-22 for information about how default values are chosen. Also see "Personalization Tag Library Configuration Files" on page 9-57.
- Specify `filteringName`, corresponding to the name of a `<Filtering>` element in `personalization.xml`, or specify individual filtering settings through the `filtering`*XXX* attributes. If you do neither, see "Recommendation Filtering" on page 9-24 for information about how default values are chosen.
- A `filteringCategories` setting is required, unless `filteringMethods` is set to "`ALL_ITEMS`" or "`ALL_CATEGORIES`". These settings can be through either the tag attributes or `personalization.xml`.
- The *XXX*`_CATEGORIES` filtering methods return categories, as defined in the mining table repository, rather than specific items.

Attributes

- `hotPicksGroups` (required)—You must use this to specify one or more hot picks groups from which the recommendations will be selected. The application must determine one or more hot picks group ID numbers, for the same recommendation engine that was specified in the `startRESession` tag. In the `hotPicksGroups` attribute, you must list the group ID numbers in a string, delimited by plus signs (+), such as "`1+20+35`".

Use all other attributes as for the `getRecommendations` tag, as described in "Personalization getRecommendations Tag" on page 9-32, except for any limitations noted in the preceding "Attribute Usage Notes".

For additional information about tuning, filtering, and sorting, see "Tuning Settings" on page 9-22, "Recommendation Filtering" on page 9-24, and "Sorting Order" on page 9-25.

See "Personalization getNextItem Tag" on page 9-44 for an example of a `selectFromHotPicks` tag that uses a nested `getNextItem` tag.

Personalization evaluateItems Tag

Use the `evaluateItems` tag to evaluate the set of items that are input to the tag. The items must all be from the same taxonomy. For an interest dimension of `PURCHASING` or `NAVIGATION`, the items are ranked. For an interest dimension of `RATING`, the items are rated. A subset of the evaluated items—anywhere from none to all of the items, depending on effects of the `tuningDataSource` setting—are returned in a TEI array variable of type `Item[]`. You must specify the name of the variable through the `storeResultsIn` attribute. For each item in the array, the `prediction` attribute contains the ranking or rating value.

See "Ratings and Rankings" on page 9-9 for background information about item ratings and rankings.

You can input items through a specified item array or through a tag body with nested `forItem` tags. See "Specification of Input Items" on page 9-18 for more information. Also see "Personalization forItem Tag" on page 9-42.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:evaluateItems
    storeResultsIn = "TEI_variable_name"
    taxonomyID = "integer_value"
  [ inputItemList = "item_array_expression" ]
  [ tuningName = "name_from_config_file_Tuning_element" ]
  [ tuningDataSource = "ALL"|"NAVIGATION"|"PURCHASE"|"RATING"|"DEMOGRAPHIC" ]
  [ tuningInterestDimension = "NAVIGATION"|"PURCHASING"|"RATING" ]
  [ tuningPersonalizationIndex = "LOW"|"MEDIUM"|"HIGH" ]
  [ tuningProfileDataBalance = "HISTORY"|"CURRENT"|"BALANCED" ]
  [ tuningProfileUsage = "INCLUDE"|"EXCLUDE" ]
  [ sortOrder = "ASCEND"|"DESCEND"|"NONE" ] >

...

</op:evaluateItems>
```

Attribute Usage Notes Be aware of the following:

- Inputting items requires either the `inputItemList` attribute, or a body with nested `forItem` tags, or optionally both. If you use both mechanisms, then the `forItem` tags will be executed first, and the indicated items will be placed in an item list. Then the `inputItemList` entries will be considered and appended to the list.
- Unlike for the `getRecommendations` tag, `storeResultsIn` is a required attribute for the `evaluateItems` tag—you must specify a TEI variable of type `Item[]` for storage of the rated items.
- Specify `tuningName`, corresponding to the name of a `<Tuning>` element in `personalization.xml`, or specify individual tuning settings through the `tuning`*XXX* attributes. If you do neither, see "Tuning Settings" on page 9-22 for information about how default values are chosen. Also see "Personalization Tag Library Configuration Files" on page 9-57.
- There are no filtering attributes for the `evaluateItems` tag, because the items to be rated are simply the items that are input. Therefore, you must specify the taxonomy through a separate attribute—`taxonomyID`.

Attributes

- `taxonomyID` (required)—This is an integer specifying the ID of the taxonomy the items are from.

- `inputItemList`—If you want to supply the input items through an `Item[]` array, use this attribute with a JSP expression that returns the array. The item array in the expression can come from a prior recommendation tag. See "Inputting Item Arrays" on page 9-19 for more information.

Use all other `evaluateItems` attributes as for the `getRecommendations` tag, as described in "Personalization getRecommendations Tag" on page 9-32, except for any limitations noted in the preceding attribute usage notes, and the fact that `storeResultsIn` is a required attribute for the `evaluateItems` tag.

For additional information about tuning and sorting, see "Tuning Settings" on page 9-22 and "Sorting Order" on page 9-25.

Example This example takes sale items as input, uses the `evaluateItems` tag to put them in order of highest interest to the user, then displays the most interesting one.

```
<% Item[] saleItems = ApplicationSupport.getSaleItems(); %>
<!-- Choose the sale items of greatest interest to this user -->
<op:evaluateItems storeResultsIn="bestItems"  taxonomyID="1"
                              inputItemList="<%=saleItems%>" />

<% ApplicationSupport.displayItem(bestItems(1)); %>
```

Personalization forItem Tag

Use this tag to specify individual items for input to a `getCrossSellRecommendations` tag or an `evaluateItems` tag.

See "Specification of Input Items" on page 9-18 for conceptual information about how to use the `forItem` tag.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:forItem
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ]
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ] />
```

The `forItem` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `index` and `itemList`.

or:

- Use both `type` and `ID`.

Attributes

- `itemList`—Use a JSP expression that returns an `Item[]` array. The item array in the expression can come from a prior recommendation tag. Use this attribute together with `index`, which specifies a desired element of the array. Do not use this attribute if you use `type` and `ID`. See "Inputting Item Arrays" on page 9-19 for more information.
- `index`—Use this to specify the index number of the desired element of an item array. Specify the item array in the `itemList` attribute. Do not use this attribute if you use `type` and `ID`.
- `type`—This is for the type of items, such as "shoes". Do not use this attribute if you use `index` and `itemList`.
- `ID`—This is an identification number, unique for each item of a given type. Do not use this attribute if you use `index` and `itemList`.

Example The following example uses several specified shoe purchasing items as input for a cross-sell recommendation, then displays the resulting recommendations.

```
<op: getCrossSellRecommendations storeResultsIn="shoeItems" >
   <op:forItem type="shoes" ID="20" />
   <op:forItem type="shoes" ID="26" />
   <op:forItem type="shoes" ID="45" />
   <op:forItem type="shoes" ID="93" />
   <op:forItem type="shoes" ID="101" />
</op:getCrossSellRecommendations>
<p> Based on past shoe purchases, here are the shoes we recommend! </p>
<%= ApplicationSupport.displayItemArray(shoeItems) %>
```

Personalization getNextItem Tag

You can optionally use nested `getNextItem` tags within a `getRecommendations` or `selectFromHotPicks` tag body to access the recommendations that the outer tag returns. (The alternative is to access the items through the `storeResultsIn` attribute of the `getRecommendations` or `selectFromHotPicks` tag.)

The first time a `getNextItem` tag is executed, it accesses the first item, and subsequent `getNextItem` executions proceed through the item array one by one, with each `getNextItem` execution taking the next item. When the end of the item array is reached, the tag puts null values into each of its tag attributes.

Use tag attributes to store either the type and ID of the next item, or the `Item` instance itself.

Be aware of the following:

- Using the explicit item array from a `getRecommendations` or `selectFromHotPicks` tag, through the `storeResultsIn` attribute, does not preclude the use of `getNextItem` tags. The item array accessible through `storeResultsIn` is unaffected by processing through `getNextItem` tags.
- If you use one or more `getRecommendations` tags nested inside another `getRecommendations` tag, or one or more `selectFromHotPicks` tags inside another `selectFromHotPicks` tag, then only one of the tags can use nested `getNextItem` tags to access implicit tag results. Other tags in the nesting chain must use the `storeResultsIn` attribute. No such restriction exists for a `getRecommendations` tag inside a `selectFromHotPicks` tag, or a `selectFromHotPicks` tag inside a `getRecommendations` tag.

Syntax

```
<op:getNextItem
          [ storeTypeIn = "TEI_variable_for_item_type" ]
          [ storeIDIn = "TEI_variable_for_item_ID" ]
          [ storeItemIn = "TEI_variable_for_Item_instance" ] />
```

The `getNextItem` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `storeTypeIn` and `storeIDIn`.

or:

- Use `storeItemIn`.

All TEI variables are of scope AT_END, meaning they are available from the end-tag to the end of the JSP page. All TEI variables must be declared in scriptlet code earlier in the page and must be visible in the scope of the getNextItem tag. Unlike TEI variables in other personalization tags, these variables will *not* be declared by the JSP container.

Attributes

- storeTypeIn—Specify the name of a TEI String variable to store the type of the next item. Use this in conjunction with storeIDIn; do not use it if you use storeItemIn.
- storeIDIn—Specify the name of a TEI String variable to store the ID of the next item. Use this in conjunction with storeTypeIn; do not use it if you use storeItemIn.
- storeItemIn—Specify the name of a TEI variable of type Item to store the next item. Do not use this if you use storeTypeIn and storeIDIn.

Examples The following example shows a getNextItem tag being used in a loop inside a getRecommendations tag. The loop terminates when getNextItem returns null.

```
<op:getRecommendations from="top"
                       tuningName="BalancedTuning"
                       filteringName="GeneralFiltering" >
<p> Top Picks selected especially for you: </p>
        <% String type=null;
           String ID=null;
           while(true) { %>
             <op:getNextItem storeTypeIn="type" storeIDIn="ID" />
             <% if(type==null) break;%>
             <li> type: <%=type%> ID: <%=ID%> </li>
        <% } %>
</op:getRecommendations>
```

And this next example shows a getNextItem tag in a loop inside a selectFromHotPicks tag:

```
<op:selectFromHotPicks hotPicksGroups="1+5"
                       tuningName="HotPicksTuning"
                       filteringName="GeneralFiltering" >
<p> We know you enjoy Horror and Musical movies. Look what we have on
sale this week! </p>
        <% Item item=null;
```

```
            while(true) { %>
              <op:getNextItem storeItemIn="item" />
              <% if(item==null) break;%>
              <li> <%= ApplicationSupport.displayItem(item) %> </li>
          <% } %>

</op:selectFromHotPicks>
```

Item Recording and Removal Tag Descriptions

This section provides detailed descriptions of the `record`*XXX* and `remove`*XXX*`Record` tags. Use the appropriate `record`*XXX* tag to record an item into the recommendation engine session cache. Use the corresponding `remove`*XXX*`Record` tag if you want to remove an item that was recorded earlier in the session. Items in the cache are periodically flushed to the recommendation engine session; removing an item after that point requires a database round-trip.

Also see "Overview of Item Recording and Removal Tags" on page 9-15.

The following tags are covered here:

- Personalization recordNavigation Tag
- Personalization recordPurchase Tag
- Personalization recordRating Tag
- Personalization recordDemographic Tag
- Personalization removeNavigationRecord Tag
- Personalization removePurchaseRecord Tag
- Personalization removeRatingRecord Tag
- Personalization removeDemographicRecord Tag

Personalization recordNavigation Tag

Use this tag to record a navigation item into the recommendation engine session. This is to record that a user demonstrated an interest in the item by navigating to it. For example, he or she may see an icon that represents something of interest, then click a **Tell Me More** button next to the icon. See "Personalization removeNavigationRecord Tag" on page 9-51 for information about the tag to remove a navigation item.

You can disable actions of the `recordNavigation` tag by setting the `disableRecording` attribute of the `startRESession` tag to "`true`". See "Personalization startRESession Tag" on page 9-27 for more information.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:recordNavigation
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `recordNavigation` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

- `type`—This is for the type of item, such as "shoes". Do not use this attribute if you use `index` and `itemList`.
- `ID`—This is an identification number, unique for each item of a given type. Do not use this attribute if you use `index` and `itemList`.
- `itemList`—Use a JSP expression that returns an `Item[]` array. The item array in the expression can come from a prior recommendation tag. Use this attribute together with `index`, which specifies a desired element of the array. Do not use this attribute if you use `type` and `ID`. See "Inputting Item Arrays" on page 9-19 for more information.
- `index`—Use this to specify the index number of the desired element of an item array. Specify the item array in the `itemList` attribute. Do not use this attribute if you use `type` and `ID`.

Personalization recordPurchase Tag

Use this tag to record a purchasing item into the recommendation engine session. This is to record a purchase the user has made. See "Personalization removePurchaseRecord Tag" on page 9-52 for information about the tag to remove a purchasing item.

You can disable actions of the `recordPurchase` tag by setting the `disableRecording` attribute of the `startRESession` tag to "`true`". See "Personalization startRESession Tag" on page 9-27 for more information.

> **Note:** Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:recordPurchase
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `recordPurchase` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

Attributes are the same as for the `recordNavigation` tag—see "Personalization recordNavigation Tag" on page 9-46.

Example Consider the following excerpts from two JSP pages.

Page 1:

```
<%@ page session="true" %>
<op:getRecommendations storeResultsIn "myRecs" />
...display recommendations...
<% session.setAttribute("recommendationList", myRecs); %>
```

Page 2:

```
<%@ page session="true" %>
<op:recordPurchase itemList="<%=session.getAttribute(\"recommendationList\") %>"
                   index="<%=request.getParameter(\"index\" %>" />
```

Page 1 obtains a list of recommendations and displays them, along with a **Buy** link for each item. The item array is stored in the `session` object for subsequent pages to use.

Page 2 is executed when the user selects a link to buy a particular recommendation. The item list is retrieved from a session attribute; the index of the item selected is retrieved from a request parameter. Page 2 may be a Shopping Cart page, for example.

Personalization recordRating Tag

Use this tag to record a rating item into the recommendation engine session. This would be based on a user rating of the item. See "Personalization removeRatingRecord Tag" on page 9-52 for information about the tag to remove a rating item.

This tag differs from `recordNavigation` and `recordPurchase` in that a value—the rating value—must also be specified.

> **Note:** Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:recordRating value = "rating_value"
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `recordRating` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

The `value` attribute is required in either case.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

- `value` (required)—This is a string representing the user rating value. An integer or floating point number can be entered. The number should be in the appropriate rating range, according to boundaries in the `MTR.MTR_BIN_BOUNDARIES` table in the mining table repository.

The other attributes are the same as for the `recordNavigation` tag—see "Personalization recordNavigation Tag" on page 9-46.

Personalization recordDemographic Tag

Use this tag to record a demographic item into the recommendation engine session. A demographic item consists of a piece of personal information about a particular user. See "Personalization removeDemographicRecord Tag" on page 9-54 for information about the tag to remove a demographic item.

This tag differs from the other `record`*`XXX`* tags in that it has only two attributes—`type` and `value`. The `type` attribute indicates what kind of information the item contains, such as "`AGE`". The `value` attribute contains the corresponding value, such as "`44`".

> **Note:** Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:recordDemographic
        type = "GENDER"|"AGE"|"MARITAL_STATUS"|"PERSONAL_INCOME"|
               "HOUSEHOLD_INCOME"|"IS_HEAD_OF_HOUSEHOLD"|"HOUSEHOLD_SIZE"|
               "RENT_OWN_INDICATOR"|"ATTRIBUTE1"|...|"ATTRIBUTE50"
        value = "item_value" />
```

The `recordDemographic` tag has no body.

Attributes

- `type` (required)—Specify one of the supported demographic types. In addition to the several named types, there are 50 customizable types—`ATTRIBUTE1`, `ATTRIBUTE2`, ..., `ATTRIBUTE50`. See "Demographic Items" on page 9-20 for additional information.

- `value` (required)—Specify an appropriate value, given the demographic type, such as "`MALE`" or "`FEMALE`" for a `GENDER` item.

Personalization removeNavigationRecord Tag

Use this tag to remove a navigation item that had been recorded into the recommendation engine session earlier in the session. See "Personalization recordNavigation Tag" on page 9-46 for information about the tag to record a navigation item.

To remove an item, you must use the `removeNavigationRecord` tag during the same recommendation engine session in which the item was recorded. The session cache is periodically flushed to the recommendation engine database schema during the course of a session. If you remove an item after it has been flushed, execution of the removal tag will require a database round-trip.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:removeNavigationRecord
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `removeNavigationRecord` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

Attributes are the same as for the `recordNavigation` tag—see "Personalization recordNavigation Tag" on page 9-46.

Personalization removePurchaseRecord Tag

Use this tag to remove a purchasing item that had been recorded into the recommendation engine session earlier in the session. See "Personalization recordPurchase Tag" on page 9-48 for information about the tag to record a purchasing item.

To remove an item, you must use the `removePurchaseRecord` tag during the same recommendation engine session in which the item was recorded. The session cache is periodically flushed to the recommendation engine database schema during the course of a session. If you remove an item after it has been flushed, execution of the removal tag will require a database round-trip.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:removePurchaseRecord
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `removePurchaseRecord` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

Attributes are the same as for the `recordNavigation` tag—see "Personalization recordNavigation Tag" on page 9-46.

Personalization removeRatingRecord Tag

Use this tag to remove a rating item that had been recorded into the recommendation engine session earlier in the session. See "Personalization

recordRating Tag" on page 9-49 for information about the tag to record a rating item.

This tag differs from `removeNavigationRecord` and `removePurchaseRecord` in that a value—the rating value—must also be specified.

To remove an item, you must use the `removeRatingRecord` tag during the same recommendation engine session in which the item was recorded. The session cache is periodically flushed to the recommendation engine database schema during the course of a session. If you remove an item after it has been flushed, execution of the removal tag will require a database round-trip.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:removeRatingRecord value = "rating_value"
          [ type = "type_of_item" ]
          [ ID = "item_ID_number" ]
          [ itemList = "item_array_expression" ]
          [ index = "index_into_item_array" ] />
```

The `removeRatingRecord` tag has no body.

Attribute Usage Notes There are two modes of use for this tag:

- Use both `type` and `ID`.

or:

- Use both `index` and `itemList`.

The `value` attribute is required in either case.

See "Specification of Input Items" on page 9-18 for related information.

Attributes

- `value` (required)—This is a string representing the user rating value that was previously recorded.

The other attributes are the same as for the `recordNavigation` tag—see "Personalization recordNavigation Tag" on page 9-46.

Personalization removeDemographicRecord Tag

Use this tag to remove a demographic item that had been recorded into the recommendation engine session earlier in the session. See "Personalization recordDemographic Tag" on page 9-50 for information about the tag to record a demographic item.

This tag differs from the other `remove`*`XXX`*`Record` tags in that it has only two attributes—`type` and `value`. The `type` attribute indicates what kind of information the item contains, such as "`AGE`". The `value` attribute contains the corresponding value, such as "`44`".

To remove an item, you must use the `removeDemographicRecord` tag during the same recommendation engine session in which the item was recorded. The session cache is periodically flushed to the recommendation engine database schema during the course of a session. If you remove an item after it has been flushed, execution of the removal tag will require a database round-trip.

Note: Also see "Personalization Tag Constraints" on page 9-56.

Syntax

```
<op:removeDemographicRecord
        type = "GENDER"|"AGE"|"MARITAL_STATUS"|"PERSONAL_INCOME"|
               "HOUSEHOLD_INCOME"|"IS_HEAD_OF_HOUSEHOLD"|"HOUSEHOLD_SIZE"|
               "RENT_OWN_INDICATOR"|"ATTRIBUTE1"|...|"ATTRIBUTE50"
        value = "item_value" />
```

The `removeDemographicRecord` tag has no body.

Attributes

Attributes are the same as for the `recordDemographic` tag—see "Personalization recordDemographic Tag" on page 9-50.

Item Class Description

The Oracle9*i*AS Personalization tag library offers the following convenient wrapper class to facilitate the use of items, categories, and recommendations in JSP pages:

`oracle.jsp.webutil.personalization.Item`

Tag handlers create `Item` instances as necessary. There are two particular scenarios , which follow, where you must use and sometimes create `Item` instances directly.

- when you want to retrieve type, ID, and prediction values from a recommendation item

  For a purchasing or navigation item, the prediction value is a ranking. For a rating item, the prediction value is a rating.

- when you want to create instances manually for input item lists for the `getCrossSellRecommendations` and `evaluateItems` tags

The `Item` class provides the following getter methods for the first scenario:

- `String getType()`—Return the item type, such as "shoes", for example, or one of the supported demographic types for demographic items. A value of "`CATEGORY`" indicates that an entire category is being recommended.
- `long getID()`—Return the item ID number.
- `float getPrediction()`—Return either the rating, for a rating item, or the ranking, for a purchasing or navigation item. Rankings are always integers, but this attribute must be floating point because ratings can be floating point.

The class provides the following setter methods for the second scenario:

- `void setType(java.lang.String)`—Set the item type.
- `void setID(long)`—Set the item ID number.

There are also methods to define the item as a category and to determine if it has already been defined as a category:

- `void setCategory()`—Set the item type to "`CATEGORY`".
- `boolean isCategory()`—Returns `true` if the item type is "`CATEGORY`".

The `Item` class provides the following public constructors:

- `new Item()`
- `new Item(String type, long ID)`
- `new Item(String type, java.lang.String ID)`

The `type` attribute must be a string; the `ID` attribute can be a string or a `long` value.

The `Item` class also defines the following `String` constant values for interest dimensions. Use these values for comparisons to values returned in the `storeInterestDimensionIn` attribute of the recommendation tags:

- `INT_DIM_NAVIGATION`—This indicates an item recommended for its high navigation interest.

- INT_DIM_PURCHASING—This indicates an item recommended for its high purchasing interest.
- INT_DIM_RATING—This indicates an item recommended for its high rating interest.

Personalization Tag Constraints

Be aware of the following constraints regarding attribute settings for the Oracle9*i*AS Personalization tags:

- The `startRESession` tag has the following limitations:
  - The `RERame` attribute has a maximum of 12 characters.
  - The `REURL` attribute has a maximum of 256 characters.
  - The `RESchema` attribute has a maximum of 30 characters.
  - The `REPassword` attribute has a maximum of 30 characters.
  - The `userID` attribute has a maximum of 32 characters.

  The same restrictions apply to the corresponding attributes of the `<RE>` element of a `personalization.xml` file, except for `userID`, which is not used in `personalization.xml`.
- There can be no more than 1024 `Item` elements passed into any tag or returned by any tag. This is not only the maximum size of any single `Item[]` array passed to or from a tag, but is also a combined maximum if any tag receives input from both an item list and one or more `forItem` tags.
- For the recommendation tags—`getRecommendations`, `getCrossSellRecommendations`, and `selectFromHotPicks`—a maximum of 1024 hot picks groups can be specified. This applies to the `fromHotPicksGroups` attribute of the `getRecommendations` and `getCrossSellRecommendations` tags, and to the `hotPicksGroups` attribute of the `fromHotPicksGroups` tag.
- Also for the recommendation tags, the `filteringCategories` attribute can specify a maximum of 256 categories.

  Equivalently, there can be a maximum of 256 `<Category>` subelements in the `<Filtering>` element of a `personalization.xml` file.
- Maximum length of the `value` attribute for the `recordDemographic`, `removeDemographicRecord`, `recordRating`, and `removeRatingRecord` tags is 60 characters.

Personalization Tag Library Configuration Files

The Oracle9*i*AS Personalization tag library supports the use of configuration files, named `personalization.xml`, to specify global and default tag attribute settings. This section documents `personalization.xml` files and their supported elements, and is organized as follows:

The personalization.xml Files

The Oracle9*i*AS Personalization tag library supports configuration files named `personalization.xml`. These files are useful in specifying default settings for optional tag attributes and for specifying default and named tuning and filtering settings. Using `personalization.xml` for tuning and filtering settings is particularly useful, because the settings can be quite involved, and it would be inconvenient to have to set them in multiple tags or multiple pages.

There can be two `personalization.xml` files relevant to a given application:

- `/WEB-INF/personalization.xml`

  Use this file for the particular application only, for any defaults or settings that are application-wide.

- `[Oracle_Home]/j2ee/home/config/personalization.xml`

  This is a server-wide configuration file. It is accessed for any required settings that cannot be found in tag attributes or in the `personalization.xml` file for the particular application.

Element Descriptions for personalization.xml

This section documents the XML DTD syntax for `personalization.xml` elements supported by the Oracle9*i*AS Personalization tag library. These elements are inside a top-level `<personalization-config>` element.

The personalization tags will validate any `personalization.xml` file against the DTD.

Note: Also see "Personalization Tag Constraints" on page 9-56. Some of these limitations apply to `personalization.xml` elements as well as to tag attribute settings.

RecommendationSettings Element

Use this element to set a default value for `maxQuantity`, the maximum number of recommendations that can be returned, for the `getRecommendations`, `getCrossSellRecommendations`, and `selectFromHotPicks` tags.

The `maxQuantity` setting must be a string representing a positive integer.

Definition

```
<!ELEMENT RecommendationSettings EMPTY>
    <!ATTLIST RecommendationSetting  maxQuantity  CDATA #REQUIRED>
```

RE Element

Use this element to specify the name of a recommendation engine connection and to make the connection. See "Personalization startRESession Tag" on page 9-27 for information about the attributes.

Definition

```
<!ELEMENT RE EMPTY>
   <!ATTLIST RE Name CDATA #REQUIRED>
   <!ATTLIST RE URL CDATA #REQUIRED>
   <!ATTLIST RE Schema CDATA #REQUIRED>
   <!ATTLIST RE Password CDATA #REQUIRED>
   <!ATTLIST RE CacheSize CDATA #REQUIRED>
   <!ATTLIST RE FlushInterval CDATA #REQUIRED>
```

You can refer to the `Name` attribute in `startRESession` tag `REName` attributes.

Tuning Element

Use this element to define named tuning settings. See "Tuning Settings" on page 9-22 for information about the attributes.

Definition

```
<!ELEMENT Tuning EMPTY>
   <!ATTLIST Tuning Name CDATA #REQUIRED>
   <!ATTLIST Tuning  DataSource
             (NAVIGATION|PURCHASING|RATING|DEMOGRAPHIC|ALL) "ALL" >
   <!ATTLIST Tuning InterestDimension (NAVIGATION|PURCHASING|RATING)
             #REQUIRED >
   <!ATTLIST Tuning PersonalizationIndex (LOW|MEDIUM|HIGH) #REQUIRED >
   <!ATTLIST Tuning  ProfileDataBalance (HISTORY|CURRENT|BALANCED)
             #REQUIRED >
   <!ATTLIST Tuning ProfileUsage (INCLUDE|EXCLUDE) "INCLUDE" >
```

The `Name` attribute is required and must give a unique name to this set of tuning settings so that the name can be referred to in recommendation tag `tuningName` attributes.

Other attributes are also required to fully define tuning settings for a recommendation request, except for `ProfileUsage`, which has a default value of `INCLUDE`. See the *Oracle9iAS Personalization Programmer's Guide* for more information.

DefaultTuning Element

Use this element for tuning settings in the absence of individual tuning tag attributes or a `tuningName` tag attribute (and corresponding `<Tuning>` element in `personalization.xml`).

Attribute meanings are the same as for the `<Tuning>` element.

Definition

```
<!ELEMENT DefaultTuning EMPTY>
   <!ATTLIST DefaultTuning  DataSource
             (NAVIGATION|PURCHASING|RATING|DEMOGRAPHIC|ALL) "ALL" >
   <!ATTLIST DefaultTuning InterestDimension (NAVIGATION|PURCHASING|RATING)
             #REQUIRED >
   <!ATTLIST DefaultTuning PersonalizationIndex (LOW|MEDIUM|HIGH)
             #REQUIRED >
   <!ATTLIST DefaultTuning ProfileDataBalance (HISTORY|CURRENT|BALANCED)
             #REQUIRED >
   <ATTLIST! DefaultTuning ProfileUsage (INCLUDE|EXCLUDE) "INCLUDE" >
```

Filtering Element and Category Elements

Use these elements to define named filtering settings. See "Recommendation Filtering" on page 9-24 for information about the attributes.

Use the filtering `Name` attribute to provide a unique name to be referenced from personalization tags.

One or more `<Category>` elements must be nested within a filtering subelement, except for the `AllItems` and `AllCategories` subelements. Contents of a `<Category>` element must be a string representing a long integer.

Definition

```
<!ELEMENT Filtering   (ExcludeItems|IncludeItems|ExcludeCategories|
                       IncludeCategories|CategoryLevel|SubTreeItems|
                       SubTreeCategories|AllItems|AllCategories) >
   <!ATTLIST Filtering Name CDATA #REQUIRED>
   <!ATTLIST Filtering TaxonomyID CDATA #REQUIRED>

<!ELEMENT Category (#PCDATA) >
<!ELEMENT ExcludeItems ( Category+ ) >
<!ELEMENT IncludeItems ( Category+ ) >
<!ELEMENT ExcludeCategories ( Category+ ) >
<!ELEMENT IncludeCategories ( Category+ ) >
<!ELEMENT CategoryLevel ( Category+ ) >
<!ELEMENT SubTreeItems ( Category+ ) >
<!ELEMENT SubTreeCategories ( Category+ ) >
<!ELEMENT AllItems EMPTY >
<!ELEMENT AllCategories EMPTY >
```

DefaultFiltering Element

Use this element for filtering settings in the absence of individual filtering tag attributes or a `filteringName` tag attribute (and corresponding `<Filtering>` element in `personalization.xml`).

Definition

```
<!ELEMENT DefaultFiltering (ExcludeItems|IncludeItems|ExcludeCategories|
                            IncludeCategories|CategoryLevel|SubTreeItems
                            SubTreeCategories|AllItems|AllCategories) >
   <!ATTLIST DefaultFiltering TaxonomyID CDATA #REQUIRED>
```

```
<!ELEMENT Category (#PCDATA) >
<!ELEMENT ExcludeItems ( Category+ ) >
<!ELEMENT IncludeItems ( Category+ ) >
<!ELEMENT ExcludeCategories ( Category+ ) >
<!ELEMENT IncludeCategories ( Category+ ) >
<!ELEMENT CategoryLevel ( Category+ ) >
<!ELEMENT SubTreeItems ( Category+ ) >
<!ELEMENT SubTreeCategories ( Category+ ) >
<!ELEMENT AllItems EMPTY >
<!ELEMENT AllCategories EMPTY >
```

Sample personalization.xml File

```
<?xml version="1.0" ?>
<personalization-config>
    <description> Sample personalization config file </description>
   <RecommendationSettings maxQuantity="5" />
   <RE Name="RE1" URL="jdbc:oracle:thin:@sid" Schema="RESCHEMA"
       Password="secret" CacheSize="2999" FlushInterval="30000" />
   <RE Name="RE2" URL="jdbc:oracle:oci:@acme" Schema="RE2-schema"
       Password="RE2-pwd" CacheSize="5555" FlushInterval="100000" />
   <Tuning Name = "tuning1" DataSource="ALL"
           InterestDimension="NAVIGATION"
           PersonalizationIndex="HIGH" ProfileDataBalance="BALANCED"
           ProfileUsage="INCLUDE" />
   <DefaultTuning DataSource="PURCHASING" InterestDimension="RATING"
           PersonalizationIndex="MEDIUM" ProfileDataBalance="CURRENT"
           ProfileUsage="EXCLUDE" />
   <Filtering Name = "filter1" TaxonomyID="25" >
      <CategoryLevel>
         <Category>10</Category>
         <Category>11</Category>
         <Category>15</Category>
      </CategoryLevel>
   </Filtering>
   <DefaultFiltering  TaxonomyID="1" >
      <AllItems/>
   </DefaultFiltering>
</personalization-config>
```

10

Web Services Tags

Oracle furnishes a tag library with OC4J that enables developers to create JSP pages for use as client programs for Web services.

This chapter describes the tag library and is organized as follows:

- Overview of Web Services
- OC4J Web Services Tags

This chapter is written with the assumption that you are already familiar with Web services, Simple Object Access Protocol (SOAP), and the Web Services Definition Language (WSDL); however, some overview is provided here. There are also references to additional documents, including related specifications from the World Wide Web Consortium (W3C).

The OC4J Web services tag library is based on Oracle9*i*AS Web Services. See the *Oracle9iAS Web Services Developer's Guide* for information.

Overview of Web Services

This section provides a quick overview of Web services concepts, covering the following topics:

General Web Services Overview

Web services are sets of procedures, or actions, that can be invoked by a client over the Internet. For example, there might be a "World Cup Soccer" service that consists of actions to get scores, schedules, and standings.

A Web service must have the following features:

- It must be able to describe itself, such as its functionality and input and output attributes. A Web service describes itself through an XML-style WSDL document. See "Overview of Web Services Definition Language Key Elements" on page 10-4.
- It must make itself generally available so that client applications can access it. The standard way to do this is to be listed in a Universal Description, Discovery, and Integration (UDDI) directory. Public UDDI directories are available to aggregate groups of businesses or users (or perhaps to anyone on the Internet), while private UDDI directories are available only within a particular business or group.
- It must be invokable so that a client application can invoke it through a standard protocol once the application has found and examined it. A leading protocol for Web services is Simple Object Access Protocol (SOAP). With SOAP, the Web service is behind a SOAP server at the server end, and the client application goes through a SOAP server at the client end. Data exchanges are "SOAP-enveloped" and can gain access through firewalls. This SOAP exchange is conceptually similar to a Remote Method Invocation (RMI) exchange, except that RMI exchanges cannot go through firewalls. See "Overview of SOAP and Related Features" on page 10-3 for a brief overview of SOAP.

- Once invoked, it must return a response to provide requested results to the client application. This is performed through the same standard protocol, such as SOAP.

For more information about Web services, particularly Oracle9*i*AS Web Services, you can refer to the *Oracle9iAS Web Services Developer's Guide*.

For related specifications, refer to the following Web sites:

`http://www.w3.org/TR/SOAP` (W3C SOAP specification)

`http://www.w3.org/TR/wsdl` (W3C WSDL specification)

`http://www.uddi.org/specification.html` (UDDI specification)

Overview of SOAP and Related Features

This section offers a brief overview of SOAP. See the W3C *Simple Object Access Protocol (SOAP) 1.1* specification for details.

SOAP is a lightweight, XML-based protocol for exchanging typed and structured data over the Internet or other distributed environments. Among other features, SOAP supports *remote procedure call* (RPC) and message-oriented data exchanges.

In a message-oriented implementation, data is exchanged through a modular packaging and encoding model. A *message* is a WSDL component that specifies input data parts and output data parts associated with an operation. See "Overview of Web Service Messages and XML Schema Definitions" on page 10-5 for more information.

RPC is an alternative to sockets, with the communication interface being at the level of procedure calls. It is as though you are calling a local procedure, but arguments of the call are actually packaged and sent to a remote target. The RPC mechanism uses a request/response methodology, where an end-point receives a procedure-oriented message and sends back a corresponding response.

Using SOAP with RPC is independent of the protocol binding. Where HTTP is the protocol binding, HTTP requests correspond to RPC calls, and HTTP responses correspond to RPC responses.

Key aspects of SOAP include the following:

- SOAP *envelope* construct—The envelope encloses a SOAP header and SOAP body and indicates what is in a message, whether it is required, and who should process it.

- SOAP encoding rules—Encoding rules define serialization mechanisms for the exchange of instances of the datatypes used in an application.
- SOAP RPC representation—The RPC representation specifies a convention for representing RPC calls and responses.

Overview of Web Services Definition Language Key Elements

A Web service is described using the XML-based Web Services Definition Language, in a WSDL (`.wsdl`) document.

Here are some key WSDL terms:

- *operation*—An operation is a particular action performed by a service, such as any of the "get scores", "get schedules", and "get standings" examples for the World Cup service.
- *message*—A message is an abstract definition that specifies the data that is being input and output for an operation.
- *port type*—A port type is an abstract definition of the operations supported by a service.
- *binding*—A binding is a protocol and data format specification for one or more operations supported by a service. A binding mechanism maps the generic or abstract definition of a Web service to a concrete implementation, including data encoding, message protocol, and communication protocol.
- *port*—A port is a single end-point, a combination of a binding and a network address. Essentially, a port is the concrete manifestation of the capabilities described by a port type. In a SOAP-based implementation, a port is a SOAP location.

  To be more precise than previously, a Web service is really a collection of related ports, or end-points, not just a collection of abstract actions or operations.

The WSDL specification outlines the general structure of a WSDL document, which includes the following key elements. Refer to the W3C *Web Services Description Language (WSDL) 1.1* specification for complete information.

- `<types>`—This element , through one or more `<schema>` subelements, contains descriptions of the data that is exchanged in messages used by the operations of the service.
- `<message>`—A `<message>` element provides an abstract definition of data being sent as input or output for an operation.

- <portType>—This element, through one or more <operation> subelements, contains abstract definitions of the operations of the Web service. An <operation> element specifies the message that is used for input and the message that is used for output for the operation.
- <binding>—This element, also through <operation> subelements, binds each operation to the particular protocol and data formats to be used.
- <service>—This element defines the ports, or end-points, of the Web service. Within the <service> element is one or more <port> subelements, where each <port> element ties a binding to an address to define the end-point.

Overview of Web Service Messages and XML Schema Definitions

Messages define parameters used by the operations, or methods, of a Web service. A message is a typed definition of the data being communicated, consisting of one or more parts. Each part corresponds to a logical entity, such as a "Purchase Order" part and an "Invoice" part. For each part, there are type specifications for the associated data items.

In a SOAP-based implementation, such as for Oracle9*i*AS Web Services, the data types used by a message are defined through the XML Schema Definition (XSD) language, which supports predefined simple types as well as user-defined complex types.

With an implementation that uses XSD, the syntax for defining a message is as follows:

```
<message name="nmtoken">
   <part name="nmtoken" [type="qname"] [element="qname"] />
</message>
```

In this syntax, the element attribute refers to where an XSD complex type is defined using XSD syntax, the type attribute indicates an XSD simple type, "nmtoken" indicates a standard XML name token, and "qname" indicates a standard XML qualified name. There can be zero or more messages, and zero or more parts for each message.

For a SOAP encoding style of encoded, only simple types are allowed, so the element attribute is not used. For an encoding style of literal, you can have simple types or complex types, so a <part> element can use either the type attribute or the element attribute, but not both.

Here is an example of a message definition, from "Example: WSDL Definition" on page 10-6:

```
<message name="GetLastTradePriceInput">
   <part name="body" element="xsd1:TradePriceRequest"/>
</message>
```

`GetLastTradePriceInput` is the name of the message, which is an input message (as the name implies). In this case, the `element` attribute refers to a namespace where a complex type, `TradePriceRequest`, is defined. Here is an example of such a definition (also part of "Example: WSDL Definition" below):

```
<element name="TradePriceRequest">
   <complexType>
      <all>
          <element name="tickerSymbol" type="string"/>
          <element name="companyName" type="string"/>
      </all>
   </complexType>
</element>
```

An XML schema primer is available from W3C at the following location:

```
http://www.w3.org/TR/xmlschema-0/
```

Web Service Example

This example shows the WSDL definition of a Web service, and illustrates its input and output messages embedded in an HTTP request and HTTP response, respectively.

Example: WSDL Definition

The W3C *Web Services Description Language (WSDL) 1.1* specification provides the following example of a WSDL document, which defines a stock quote service that takes a ticker symbol as input and returns the current stock price as output. Note this uses a SOAP encoding style of `literal`, so complex types are allowed (and used).

```
<?xml version="1.0"?>
<definitions name="StockQuote"

targetNamespace="http://example.com/stockquote.wsdl"
          xmlns:tns="http://example.com/stockquote.wsdl"
```

```
       xmlns:xsd1="http://example.com/stockquote.xsd"
       xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
       xmlns="http://schemas.xmlsoap.org/wsdl/">

<types>
   <schema targetNamespace="http://example.com/stockquote.xsd"
           xmlns="http://www.w3.org/2000/10/XMLSchema">
      <element name="TradePriceRequest">
         <complexType>
            <all>
               <element name="tickerSymbol" type="string"/>
            </all>
         </complexType>
      </element>
      <element name="TradePrice">
         <complexType>
            <all>
               <element name="price" type="float"/>
            </all>
         </complexType>
      </element>
   </schema>
</types>

<message name="GetLastTradePriceInput">
   <part name="body" element="xsd1:TradePriceRequest"/>
</message>

<message name="GetLastTradePriceOutput">
   <part name="body" element="xsd1:TradePrice"/>
</message>

<portType name="StockQuotePortType">
   <operation name="GetLastTradePrice">
      <input message="tns:GetLastTradePriceInput"/>
      <output message="tns:GetLastTradePriceOutput"/>
   </operation>
</portType>

<binding name="StockQuoteSoapBinding" type="tns:StockQuotePortType">
   <soap:binding style="document"
                 transport="http://schemas.xmlsoap.org/soap/http"/>
   <operation name="GetLastTradePrice">
      <soap:operation soapAction="http://example.com/GetLastTradePrice"/>
         <input>
```

```
            <soap:body use="literal"/>
         </input>
         <output>
            <soap:body use="literal"/>
         </output>
      </operation>
   </binding>

   <service name="StockQuoteService">
      <documentation>My first service</documentation>
         <port name="StockQuotePort" binding="tns:StockQuoteBinding">
            <soap:address location="http://example.com/stockquote"/>
          </port>
   </service>

</definitions>
```

This WSDL definition first specifies the `GetLastTradePriceInput` and `GetLastTradePriceOutput` input and output messages, next ties them to the operation `GetLastTradePrice`, then defines a binding and a port for that operation.

Notes:

- This example has all aspects of the Web service definition, including the XML schema definitions for data exchanges, in the same document. Alternatively, `stockquote.xsd`, for example, could be a separate XSD document instead of a namespace within this document. The W3C WSDL specification illustrates this. Be aware, however, that the OC4J Web services tag library does *not* support WSDL documents that use `<import>` elements to import other WSDL documents.
- The example uses a document-style binding. Be aware that the OC4J Web services tag library implementation supports only RPC-style bindings as of Oracle9*i*AS release 2 (9.0.3).

Example: SOAP Messages Embedded in HTTP Request and Response

Corresponding to the Web service defined in the preceding example, this section shows what the messages would look like—the soap-enveloped input message embedded in an HTTP request, and the soap-enveloped output message embedded

in an HTTP response. These examples are also from the W3C *Web Services Description Language (WSDL) 1.1* specification.

Here is a request:

```
POST /StockQuote HTTP/1.1
Host: www.stockquoteserver.com
Content-Type: text/xml; charset="utf-8"
Content-Length: nnnn
SOAPAction: "SOAP_URI"

   <soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
      <soapenv:Body>
         <m:GetLastTradePrice xmlns:m="xmlns_URI">
            <m:tickerSymbol>DIS</m:tickerSymbol>
         </m:GetLastTradePrice>
      </soapenv:Body>
   </soapenv:Envelope>
```

In this example, *xmlns_URI* is a URI to the location where the `GetLastTradePrice` operation and its messages are defined, such as the WSDL document in the preceding "Example: WSDL Definition". This is also where `tickerSymbol` is defined. The request is for a stock quote for Walt Disney Co. *SOAP_URI* is the URI for the SOAP action HTTP header for the HTTP binding of SOAP.

And here is the response:

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset="utf-8"
Content-Length: nnnn

   <soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
      <soapenv:Body>
         <m:GetLastTradePriceResponse xmlns:m="Some_URI">
            <m:price>34.5</m:price>
         </m:GetLastTradePriceResponse>
      </soapenv:Body>
   </soapenv:Envelope>
```

By convention, the response for an operation *Xxxx* is called *Xxxx*`Response`.

OC4J Web Services Tags

This section provides an overview and details of the Web services tag library, as well as an overview of Oracle9*i*AS Web Services, upon which the tag library implementation is based. The section is organized as follows:

Overview of Oracle9*i*AS Web Services and the Tag Library Implementation

The Web services tag library provided with OC4J enables developers to conveniently create JSP pages for Web service client applications. The implementation uses a SOAP-based, RPC-style mechanism. A client application would access the WSDL document, and then use the WSDL information to access the operations of a Web service.

The tag library also uses the Oracle implementation of the dynamic invocation API, described in the *Oracle9iAS Web Services Developer's Guide*. When a client application acquires a WSDL document at runtime, the dynamic invocation API is the vehicle for invoking any SOAP operation described in the WSDL document. The tag handler uses the API in sending a SOAP request that invokes a Web service, and in handling the SOAP response.

The Oracle dynamic invocation API consists of classes and interfaces in the `oracle.j2ee.ws.client` and `oracle.j2ee.ws.client.wsdl` packages.

The `oracle.j2ee.ws.client` package includes the following:

- `WebServiceProxyFactory`—Given a WSDL document (through a Java input stream that contains the document or through the URL of the document), a `WebServiceProxyFactory` instance can use the name of a service and the name of one of its ports, as specified in the WSDL document, to instantiate a `WebServiceProxy` class (a class that implements the `WebServiceProxy` interface).
- `WebServiceProxy`—Use this interface in representing a service defined in a WSDL document. Each `WebServiceProxy` instance is based on the location of the WSDL document and, optionally, on additional qualifiers that identify which service and port should be used. A `WebServiceProxy` class exposes methods to determine the WSDL port type, including the syntax and signatures

of all operations exposed by the WSDL document, and to invoke the defined operations.

- `WebServiceMethod`—Use this interface in invoking a Web service method, or operation.

The `oracle.j2ee.ws.client.wsdl` package includes the following:

- `Operation`—This interface represents a WSDL operation.
- `Message`—This interface describes a message used in the input or output of an operation.
- `Part`—This interface describes a message part.
- `Input`—This interface represents an input message.
- `Output`—This interface represents an output message.

Note: The dynamic invocation API is packaged in `dsv2.jar` in the `[Oracle_Home]/webservices/lib` directory. Also note that the SOAP implementation requires `soap.jar` in the `[Oracle_Home]/soap` directory.

Overview of Web Services Tag Functionality

This section provides an overview of the OC4J Web services tag library and its functionality. The tag library includes support for binding to a Web service, using a Web service operation through SOAP requests and SOAP responses, defining input and output message parts, mapping SOAP/XML data types to Java types, and setting custom properties for use by the client application.

The tag library supports invoking operations defined in WSDL documents that use the W3C XML schema version whose namespace is the following:

```
http://www.w3.org/2001/XMLSchema
```

The Web services tag library includes the `webservice` tag, optionally with nested `map` and `property` tags, and the `invoke` tag, optionally with nested `part` tags. They are used as follows.

- `webservice`—Use this tag to create a Web service proxy. The tag requires the URL of a WSDL document and then uses one of the following combinations:
  - a binding and SOAP location (useful for a WSDL document identified in a UDDI registry)

  - a service name and port (either provided through tag attributes, or the first service and its first port from the WSDL document)

- `map`—The Web service proxy uses this tag, if specified, to add an entry to the SOAP mapping registry, which is a registry that maps local SOAP/XML types to Java types. Any number of `map` tags can be nested within a `webservice` tag, one tag for each desired type mapping.
- `property`—Optionally, use this tag to define any of several supported custom properties for use by the Web service client application. Each `property` tag must be nested within the `webservice` tag, and the property will have the same scope as the parent Web service.
- `invoke`—Use this tag to invoke an operation of the Web service. An `invoke` tag accesses a Web service proxy either by being nested within a `webservice` tag, or through a scripting variable.
- `part`—Use this tag if the operation has input message parts, one `part` tag for each input part.

Note: As of Oracle9*i*AS release 2 (9.0.3):

- Although message-style Web services are supported by Oracle9*i*AS Web Services, only RPC-style services are currently supported by the tag library.
- The tag library does not support the use of `<import>` elements within WSDL documents to import other WSDL documents.
- Custom bindings, including custom HTTP bindings or custom MIME bindings, are not supported.

Because the OC4J Web services tag library implementation is based on the Oracle9*i*AS Web Services implementation, any additional limitations of Oracle9*i*AS Web Services also apply to the tag library.

Web Services Tag Descriptions

This section supplies detailed descriptions of the OC4J Web services tags, including syntax documentation:

- Web Services webservice Tag
- Web Services map Tag
- Web Services property Tag

- Web Services invoke Tag
- Web Services part Tag

The Web services tag library, a standards-compliant JavaServer Pages tag library implementation, is included in the `ojsputil.jar` file, which is provided with OC4J. Verify that this file is installed and in your classpath.

To use the Web services tag library, the tag library descriptor file, `wstaglib.tld`, must be deployed with the application, and any JSP page using the library must have an appropriate `taglib` directive. In an Oracle9*i*AS installation, the TLD file is in the "well-known" tag library directory. Refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for information about `taglib` directives and the well-known tag library directory.

For an example that uses the tags described in this section, see "Web Services Tag Examples" on page 10-19.

Notes:

- The prefix "ws:" is used in the tag syntax here. This is by convention, but is not required. You can specify any desired prefix in the `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

Web Services webservice Tag

Use this tag to create a Web service proxy—an instance of a class that implements the `oracle.j2ee.ws.client.WebServiceProxy` interface. The tag requires the URL of a WSDL document and uses a binding and SOAP location or a service name and port, as follows:

1. First, if tag attributes provide a binding and SOAP location, the tag handler uses them in creating the proxy. (Tag attributes for service name and port are ignored in this case.)
2. If no binding and SOAP location are provided, the tag handler uses a service name and port, as follows:
   a. If a service name and port are provided through tag attributes, then the tag handler uses them in creating the proxy.
   b. If no service name and port are provided, the tag handler uses the first service in the WSDL document, and the first port listed for that service.

Using a binding and SOAP location is particularly useful for a Web service whose WSDL document is accessed through a UDDI registry. In that case, the binding and location can be determined through UDDI queries and supplied to the tag through request-time expressions.

After the Web service proxy is created, it will use any nested `map` tags to add entries to the SOAP mapping registry. See the next section, "Web Services map Tag".

Syntax

```
<ws:webservice wsdlUrl = "WSDL_URL_of_Web_service"
               [ id = "variable_name_for_Web_service_proxy" ]
               [ scope = "page" | "request" | "session" | "application" ]
               [ binding = "SOAP_binding_information" ]
               [ soapLocation = "SOAP_endpoint_URL" ]
               [ service = "service_name_in_WSDL" ]
               [ port = "port_name_for_service" ]

...body / nested tags...

</ws:webservice>
```

Note: The `scope` attribute *cannot* take request-time expressions.

Attributes

- `wsdlUrl` (required)—Use this attribute to specify a URL where the WSDL for the desired Web service can be accessed.
- `id`—If the Web service is to be accessed by an `invoke` tag that is *not* nested within the `webservice` tag, use the `id` attribute to specify the name for a `WebServiceProxy` scripting variable so that the variable can be referenced by the `invoke` tag. The specified name must be a valid Java identifier. When you use the `id` attribute, the specified variable will be declared automatically with scope `AT_END` (available from the `webservice` end-tag to the end of the JSP page).
- `scope`—Optionally, specify the scope of the `webservice` tag. The default setting is "`page`".
- `binding`—In scenario #1 above, use the `binding` attribute to specify the SOAP binding information for a SOAP location (end-point URL) that you specify through the `soapLocation` attribute. You must use these attributes together.

The binding information is as defined in the WSDL document, specifying concrete protocol and data format specifications for the operations and messages defined by a particular port type.

- `soapLocation`—In scenario #1 above, use `soapLocation` to specify a SOAP location (end-point URL), as defined in the WSDL document, for which the binding information specified through the `binding` attribute applies. You must use these attributes together.
- `service`—In scenario #2a above, use the `service` attribute to specify the name of a service defined in the WSDL document. You must use this attribute with the `port` attribute, but both are ignored if you use `binding` and `soapLocation`.
- `port`—In scenario #2a above, use the `port` attribute to specify a port for the service that is specified through the `service` attribute. You must use these attributes together. The Web service proxy will use the specified port. The port address will be as specified in the corresponding `<service>` element in the WSDL document. The `service` and `port` attributes are ignored if you use `binding` and `soapLocation`.

Web Services map Tag

For interoperability, a mapping mechanism is necessary to map WSDL-defined SOAP/XML data types to the Java types used in JSP pages of a Java client application. This is possible through the Oracle9*i*AS Web Services SOAP mapping registry.

You can have any number of `map` tags nested within a `webservice` tag, to have the Web service proxy add entries to the registry. Use one `map` tag for each desired type mapping.

The registry is an instance of the `XMLJavaMappingRegistry` class of the `org.apache.soap.util.xml` package. A `WebServiceProxy` instance has a `getXMLMappingRegistry()` method to access the registry.

The `map` tag includes attributes to specify the encoding style, serializer, deserializer, and namespace URI to facilitate the type mapping. The Web services tag library supports custom serializers and deserializers, if you want to create your own.

Important: When using a `map` tag, you must nest it within a `webservice` tag.

Syntax

```
<ws:map localName = "local_name_of_SOAPXML_type"
        namespaceUri = "URI_of_namespace_for_SOAPXML_type"
        javaType = "Java_type_to_map"
        encodingStyle = "URL_of_SOAP_encoding_style"
        java2xmlClassName = "Java_to_XML_serializer"
        xml2javaClassName = "XML_to_Java_deserializer" />
```

Attributes

- `localName` (required)—Specify the local name of the SOAP/XML data type, such as `SOAPStruct`, for example.
- `namespaceUri` (required)—Specify a valid URI for the namespace of the SOAP/XML data type. The following is an example:

  ```
  http://soapinterop.org/xsd
  ```

- `javaType` (required)—Specify the Java type which you want to map to the SOAP/XML type. The types must be legally mappable.
- `encodingStyle` (required)—Specify a valid URL for a SOAP encoding style. The following is an example:

  ```
  http://schemas.xmlsoap.org/soap/encoding
  ```

- `java2xmlClassName` (required)—Specify the class name with the functionality for serializing the data for Java-to-XML conversion. This can be a custom class. The following is an example:

  ```
  org.apache.soap.encoding.soapenc.BeanSerializer
  ```

- `xml2javaClassName` (required)—Specify the class name with the functionality for deserializing the data for XML-to-Java conversion. This can be a custom class. The following is an example:

  ```
  org.apache.soap.encoding.soapenc.BeanSerializer
  ```

Web Services property Tag

You can optionally use this tag to specify a name/value pair that defines any of several supported custom properties for use by the Web service client application. For example, you could use `property` tags to specify an HTTP proxy host and

proxy port if a proxy is required for access through a network firewall. The following properties are supported:

- `http.proxyHost`—Use this property to specify the host name of an HTTP proxy server.
- `http.proxyPort`—Use this property to specify a port number of an HTTP proxy server.
- `javax.net.ssl.KeyStore`—Use this property to specify the full path of an Oracle security wallet file.

Important: When using a `property` tag, you must nest it within a `webservice` tag. The property will have the same scope as the parent Web service.

Syntax

```
<ws:property name="http.proxyHost" | "http.proxyPort" | "javax.net.ssl.KeyStore"
             value = "property_value" />
```

Attributes

- `property` (required)—Specify the property you want to set; it must be one of the supported properties listed in the tag syntax.
- `value` (required)—Specify the desired value of the property (a host name, port number, or full path to an Oracle wallet file).

Web Services invoke Tag

Use this tag to invoke an operation of the Web service. The tag handler will call the remote Web service operation by passing an input message in a SOAP request, then will wait for the SOAP response. You must specify the operation, and an object ID for the object that will contain the returned response. The tag handler uses the operation name to find the operation in the WSDL document.

The `invoke` tag gains access to a Web service proxy in one of two ways:

- The `invoke` tag is nested within the `webservice` tag that establishes the proxy.
- The `invoke` tag uses its `webservice` attribute to access a `WebProxyService` scripting variable created through a `webservice` tag `id` attribute.

In a situation where there are overloaded operations—two operations of the same name using different I/O messages—the `invoke` tag has attributes to specify the input and output message names for the desired operation. In this case, the specified input and output message names are used to form the RPC signature of the operation. Otherwise, the RPC signature is the default according to the WSDL document.

If the output message has multiple parts, then the returned result is an array of message parts (all within a single SOAP response).

Important: Waiting for the SOAP response is a blocking function.

Syntax

```
<ws:invoke id = "variable_name_for_output_result"
           operation = "operation_to_invoke"
         [ webservice = "variable_name_of_Web_service_proxy" ]
         [ inputMsgName = "name_of_input_message" ]
         [ outputMsgName = "name_of_output_message" ]

...body / nested tags...

</ws:invoke>
```

Attributes

- `id` (required)—Specify a scripting variable name for the output result object. The specified name must be a valid Java identifier. The variable will be declared automatically with scope `AT_END` (available from the `invoke` end-tag to the end of the JSP page).
- `operation` (required)—Specify an operation to be executed (an operation from the WSDL document).
- `webservice`—Use this attribute if you want to specify the name of a `WebServiceProxy` scripting variable corresponding to the service to invoke. This is not necessary if the `invoke` tag is nested inside the `webservice` tag that accesses the desired service.
- `inputMsgName`—Optionally specify the input message name—the name of a `wsdl:input` tag in the WSDL document—for the operation. This is only necessary if there are overloaded operations (operations with the same name that use different message names).

- `outputMsgName`—Optionally specify the output message name—the name of a `wsdl:output` tag in the WSDL document—for the operation. This is necessary only if there are overloaded operations (operations with the same name that use different message names).

Web Services part Tag

Use this tag if the operation being performed requires input message part values, using one `part` tag for each input part.

Important: When using a `part` tag, you must nest it within an `invoke` tag.

Syntax

```
<ws:part name = "part_name"
         value = "part_value" />
```

Attributes

- `name` (required)—Specify the name of the input part (a valid Java identifier).
- `value` (required)—Specify the value of the input part.

Web Services Tag Examples

This section provides two examples—a template for use of the tag library, and a concrete JSP page example.

Web Services Example: Usage Template

```
<HTML>
<HEAD>
<TITLE>Title</TITLE>
</HEAD>
<BODY>
<H2>This is sample HTML text.</H2>
<%@ taglib uri="http://xmlns.oracle.com/j2ee/jsp/tld/ws/WsTagLibrary.tld"
           prefix="ws" %>
<ws:webservice id="myws"
               wsdlUrl="wsdlurl"
               {
                  binding="" soapLocation="" | service="" port=""
```

```
                }
                {
                   scope="page | request | session | application"
                }
                 >
   <ws:property name="property" value="string"/>

   <ws:map encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
           localname="SOAPStruct"
           namespaceUri="http://soapinterop.org/xsd"
           javaType="MySoapStructBean"
           java2xmlClassName="org.apache.soap.encoding.soapenc.BeanSerializer"
           xml2javaClassName="org.apache.soap.encoding.soapenc.BeanSerializer"
    />

</ws:webservice>

<ws:invoke id="result" webservice="myws" operation="add" inputMsgName=""
           outputMsgName="">
   <ws:part name="part_name" value="{string | <%= expression %>}"/>
</ws:invoke>

<% =result %>
</BODY>
</HTML>
```

Web Services Example: Sample JSP Page

```
<%@ page contentType="text/html"%>
<%@ taglib uri="http://xmlns.oracle.com/j2ee/jsp/tld/ws/wstaglib.tld"
           prefix="ws" %>
<HTML>
<HEAD>
<META HTTP-EQUIV="Content-Type" CONTENT="text/html; ">
</HEAD>
<BODY>
<%
 String itemID = request.getParameter("itemID");
%>
<ws:webservice id="ebay"
    wsdlUrl="http://www.xmethods.net/sd/2001/EBayWatcherService.wsdl"
    binding="eBayWatcherBinding"
    soapLocation="http://services.xmethods.net:80/soap/servlet/rpcrouter"
    scope="page">
```

```
  <ws:property name="http.proxyHost" value="www-proxy.us.oracle.com"/>
  <ws:property name="http.proxyPort" value="80"/>
</ws:webservice>
<ws:invoke id="price" webservice="ebay" operation="getCurrentPrice">
  <ws:part name="auction_id" value="<%=itemID%>"/>
</ws:invoke>
<B>
Action price for eBay Item # <%=itemID%> is :
</B>
<P>
$<%= price%>
@
<%= new java.util.Date()%>
</P>
</BODY>
</HTML>
```

A

JML Compile-Time Syntax and Tags

Oracle JSP releases prior to the implementation of the JSP 1.1 specification could support JML tags only as Oracle-specific extensions. The tag library framework was added in the Sun Microsystems *JavaServer Pages Specification, Version 1.1*. For the pre-1.1 releases, JML tag processing was built into the JSP translator. This is referred to as *compile-time tag support* in this manual.

JSP releases with OC4J continue to support the compile-time JML implementation; however, it is generally advisable to use the standards-compliant runtime implementation whenever possible. The runtime implementation is documented in Chapter 3, "JSP Markup Language Tags".

This appendix discusses features of the compile-time implementation that are not in common with the runtime implementation. This includes the following topics:

- JML Compile-Time Syntax Support
- JML Compile-Time Tag Support

For a general discussion of when it may be advantageous to use a compile-time implementation, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide*.

JML Compile-Time Syntax Support

This section describes Oracle-specific bean reference syntax and expression syntax supported by the compile-time JML implementation for specifying tag attribute values. The following topics are covered:

- JML Bean References and Expressions, Compile-Time Implementation
- Attribute Settings with JML Expressions

This functionality requires the OC4J JSP translator; it is not portable to other JSP environments.

JML Bean References and Expressions, Compile-Time Implementation

A *bean reference* is any reference to a JavaBean instance (bean) that results in accessing either a property or a method of the bean. This includes a reference to a property or method of a bean where the bean itself is a property of another bean.

This becomes cumbersome, because standard JavaBeans syntax requires that properties be accessed by calling their accessor methods rather than by direct reference. For example, consider the following direct reference:

```
a.b.c.d.doIt()
```

This must be expressed as follows in standard JavaBeans syntax:

```
a.getB().getC().getD().doIt()
```

The Oracle compile-time JML implementation, however, offers abbreviated syntax, as described in the following subsections.

JML Bean References

Oracle-specific syntax supported by the compile-time JML implementation allows bean references to be expressed using direct dot (".") notation. Note that standard bean property accessor method syntax is also still valid.

Consider the following standard JavaBean reference:

```
customer.getName()
```

In JML bean reference syntax, you can express this in either of the following ways:

```
customer.getName()
```

or:

```
customer.name
```

JavaBeans can optionally have a default property, whose reference is assumed if no reference is explicitly stated. You can omit default property names in JML bean references. In the example above, if `name` is the default property, then the following are all valid JML bean references:

```
customer.getName()
```

or:

```
customer.name
```

or simply:

```
customer
```

Most JavaBeans do not define a default property. Of those that do, the most significant are the JML datatype JavaBeans described in Chapter 2, "JavaBeans for Extended Types".

JML Expressions

JML expression syntax supported by the compile-time JML implementation is a superset of standard JSP expression syntax, adding support for the JML bean reference syntax documented in the preceding section.

A JML bean reference appearing in a JML expression must be enclosed in the following syntax:

$[*JML_bean_reference*]

Attribute Settings with JML Expressions

Tag attribute documentation under "JSP Markup Language (JML) Tag Descriptions" on page 3-4 notes standards-compliant syntax. You can set attributes, as documented there, for either the runtime or the compile-time JML implementation and even for non-Oracle JSP environments.

If you intend to use only the Oracle-specific compile-time implementation, however, you can set attributes using JML bean references and JML expression syntax, as documented in the preceding section, "JML Bean References and Expressions, Compile-Time Implementation". Note the following requirements.

- Wherever Chapter 3 documents an attribute that accepts either a string literal or an expression, you can use a JML expression in its `$[...]` syntax inside standard JSP `<%=...%>` syntax.

  Consider an example using the JML `useVariable` tag. You would use syntax such as the following for the runtime implementation:

```
<jml:useVariable id = "isValidUser" type = "boolean" value = "<%= dbConn.isValid() %>" scope = "session" />
```

  You can alternatively use syntax such as the following for the compile-time implementation (the `value` attribute can be either a string literal or an expression):

```
<jml:useVariable id = "isValidUser" type = "boolean" value = "<%= $[dbConn.valid] %>" scope = "session" />
```

- Wherever Chapter 3 documents an attribute that accepts an expression only, you can use a JML expression in its `$[...]` syntax without being nested in `<%=...%>` syntax.

  Consider an example using JML `choose...when` tags. You would use something such as the following syntax for the runtime implementation (presuming `orderedItem` is a `JmlBoolean` instance):

```
<jml:choose>
     <jml:when condition = "<%= orderedItem.getValue() %>"  >
               You have changed your order:
             -- outputs the current order --
     </jml:when>
     <jml:otherwise>
               Are you sure we can't interest you in something?
     </jml:otherwise>
</jml:choose>
```

  You can alternatively use syntax such as the following for the compile-time implementation (where the `condition` attribute can be an expression only):

```
<jml:choose>
     <jml:when condition = "$[orderedItem]"  >
               You have changed your order:
             -- outputs the current order --
     </jml:when>
     <jml:otherwise>
               Are you sure we can't interest you in something?
     </jml:otherwise>
</jml:choose>
```

JML Compile-Time Tag Support

This section presents the following:

- documentation of the `taglib` directive you must use for compile-time JML support
- a summary of all compile-time tags, noting which are desupported in the runtime implementation
- a description of tags supported by the compile-time implementation that are desupported in the runtime implementation

  Tags still supported in the runtime implementation are documented in "JSP Markup Language (JML) Tag Descriptions" on page 3-4.

Note: In most cases, JML tags that are desupported in the runtime implementation have standard JSP equivalents. Some of the compile-time tags, however, were desupported because they have functionality that is difficult to implement when adhering to the JSP 1.1 or higher specification.

The taglib Directive for Compile-Time JML Support

The Oracle compile-time JML support implementation uses a custom class, `OpenJspRegisterLib`, to implement JML tag support.

In a JSP page using JML tags with the compile-time implementation, the `taglib` directive must specify the fully qualified name of this class (instead of specifying a TLD file as in standard JSP tag library usage).

Following is an example:

```
<%@ taglib uri="oracle.jsp.parse.OpenJspRegisterLib" prefix="jml" %>
```

For information about usage of the `taglib` directive for the JML runtime implementation, see "Overview of the JSP Markup Language (JML) Tag Library" on page 3-2.

JML Tag Summary, Compile-Time Versus Runtime

Most JML tags are available in both the runtime model and the compile-time model; however, there are exceptions, as summarized in Table 10–1.

Table 10–1 JML Tags Supported: Compile-Time Model Versus Runtime Model

Tag	Supported in Oracle Compile-Time Implementation?	Supported in Oracle Runtime Implementation?
Bean Binding Tags:		
useBean	Yes	No; use `jsp:useBean`.
useVariable	Yes	Yes
useForm	Yes	Yes
useCookie	Yes	Yes
remove	Yes	Yes
Bean Manipulation Tags:		
getProperty	Yes	No; use `jsp:getProperty`.
setProperty	Yes	No; use `jsp:setProperty`.
set	Yes	No
call	Yes	No
lock	Yes	No
Control Flow Tags:		
if	Yes	Yes
choose	Yes	Yes
for	Yes	Yes
foreach	Yes; `type` attribute is optional.	Yes; `type` attribute is required.
return	Yes	Yes
flush	Yes	Yes
include	Yes	No; use `jsp:include`.
forward	Yes	No; use `jsp:forward`.
XML Tags:		
transform	Deprecated	Yes

Table 10–1 JML Tags Supported: Compile-Time Model Versus Runtime Model (Cont.)

Tag	Supported in Oracle Compile-Time Implementation?	Supported in Oracle Runtime Implementation?
styleSheet	Deprecated	Yes
Utility Tags:		
print	Yes; use double-quotes to specify a string literal.	No; use JSP expressions.
plugin	Yes	No; use `jsp:plugin`.

Note: As of Oracle9*i*AS release 2 (9.0.3), the `transform` and `styleSheet` tags are deprecated in the compile-time implementation.

Descriptions of Additional JML Tags, Compile-Time Implementation

This section provides detailed descriptions of JML tags that are still supported by the JML compile-time implementation but are not supported by the JML runtime implementation. The tags supported in the runtime implementation are documented under "JSP Markup Language (JML) Tag Descriptions" on page 3-4.

The following JML tags, for compile-time only, are documented here:

- JML useBean Tag
- JML getProperty Tag
- JML setProperty Tag
- JML set Tag
- JML call Tag
- JML lock Tag
- JML include Tag
- JML forward Tag
- JML print Tag
- JML plugin Tag

Notes:

- The prefix "jml:" is used in the tag syntax here. This is by convention but is not required. You can specify any desired prefix in your `taglib` directive.
- See "Tag Syntax Symbology and Notes" on page 1-2 for general information about tag syntax conventions in this manual.

JML useBean Tag

This tag declares an object to be used in the page, locating the previously instantiated object at the specified scope by name if it exists. If it does not exist, the tag creates a new instance of the appropriate class and attaches it to the specified scope by name.

The syntax and semantics are the same as for the standard `jsp:useBean` tag, except that wherever a JSP expression is valid in `jsp:useBean` usage, either a JML expression or a JSP expression is valid in JML `useBean` usage. You can refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* for an overview of the `jsp:useBean` tag.

Syntax

```
<jml:useBean id = "beanInstanceName"
[ scope ="page" | "request" | "session" | "application" ]
  class ="package.class" |
  type = "package.class" |
  class ="package.class" type = "package.class" |
  beanName = "package.class" | "<%= jmlExpression %>" type = "package.class"  />
```

Alternatively, you can have additional nested tags, such as `setProperty` tags, and use a `</jml:useBean>` end-tag.

Attributes

Refer to the Sun Microsystems *JavaServer Pages Specification, Version 1.2* for detailed information about `jsp:useBean` attributes and their syntax.

Example

```
<jml:useBean id = "isValidUser" class = "oracle.jsp.jml.JmlBoolean" scope = "session" />
```

JML getProperty Tag

This tag is functionally identical to the standard `jsp:getProperty` tag. It prints the value of the bean property into the response.

For general information about `getProperty` usage, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* or the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Syntax

```
<jml:getProperty name = "beanInstanceName"
                 property = "propertyName" />
```

Attributes

- `name` (required)—This is the name of the bean whose property is being retrieved.
- `property` (required)—This is the name of the property being retrieved.

Example The following example outputs the current value of the `salary` property. Assume `salary` is of type `JmlNumber`.

```
<jml:getProperty name="salary" property="value" />
```

This is equivalent to the following:

```
<%= salary.getValue() %>
```

JML setProperty Tag

This tag covers the functionality supported by the standard `jsp:setProperty` tag, but also adds functionality to support JML expressions. In particular, you can use JML bean references.

For general information about `setProperty` usage, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* or the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Syntax

```
<jml:setProperty name = "beanInstanceName"
                 property = " * " |
                 property = "propertyName" [ param = "parameterName" ] |
                 property = "propertyName"
               [ value = "stringLiteral" | "<%= jmlExpression %>" ] />
```

Attributes

- `name` (required)—This is the name of the bean whose property is being set.
- `property` (required)—This is the name of the property being set.
- `value`—This is an optional parameter that lets you set the value directly instead of from a request parameter. The JML `setProperty` tag supports JML expressions in addition to standard JSP expressions to specify the value.

Example The following example updates `salary` with a six percent raise. (Assume `salary` is of type `JmlNumber`.)

```
<jml:setProperty name="salary" property="value" value="<%= $[salary] * 1.06 %>" />
```

This is equivalent to the following:

```
<% salary.setValue(salary.getValue() * 1.06); %>
```

JML set Tag

This tag provides an alternative for setting a bean property, using syntax that is more convenient than that of the `setProperty` tag.

Syntax

```
<jml:set name = "beanInstanceName.propertyName"
         value = "stringLiteral" | "<%= jmlExpression %>" />
```

Attributes

- `name` (required)—This is a direct reference (JML bean reference) to the bean property to be set.
- `value` (required)—This is the new property value. It is expressed either as a string literal, a JML expression, or a standard JSP expression.

Example Each of the following examples updates `salary` with a six percent raise. (Assume `salary` is of type `JmlNumber`.)

```
<jml:set name="salary.value" value="<%= salary.getValue() * 1.06 %>" />
```

or:

```
<jml:set name="salary.value" value="<%= $[salary.value] * 1.06 %>" />
```

or:

```
<jml:set name="salary" value="<%= $[salary] * 1.06 %>" />
```

These are equivalent to the following:

```
<% salary.setValue(salary.getValue() * 1.06); %>
```

JML call Tag

This tag provides a mechanism to invoke bean methods that return nothing.

Syntax

```
<jml:call method = "beanInstanceName.methodName(parameters)" />
```

Attributes

- `method` (required)—This is the method call as you would write it in a scriptlet, except that the *`beanInstancename.methodName`* portion of the statement can be written as a JML bean reference if enclosed in JML expression `$[... ]` syntax.

Example The following example redirects the client to a different page:

```
<jml:call name='response.sendRedirect("http://www.oracle.com/")' />
```

This is equivalent to the following:

```
<% response.sendRedirect("http://www.oracle.com/"); %>
```

JML lock Tag

This tag allows controlled, synchronous access to the named object for any code that uses it within the tag body.

Generally, JSP developers need not be concerned with concurrency issues. However, because application-scope objects are shared across all users running the application, access to critical data must be controlled and coordinated.

You can use the JML `lock` tag to prevent concurrent updates by different users.

Syntax

```
<jml:lock name = "beanInstanceName" >
   ...body...
</jml:lock>
```

Attributes

- `name` (required)—This is the name of the object that should be locked during execution of code in the `lock` tag body.

Example In the following example, `pageCount` is an application-scope `JmlNumber` value. The variable is locked to prevent the value from being updated by another user between the time this code gets the current value and the time it sets the new value.

```
<jml:lock name="pageCount" >
    <jml:set name="pageCount.value" value="<%= pageCount.getValue() + 1 %>" />
</jml:lock>
```

This is equivalent to the following:

```
<% synchronized(pageCount)
   {
      pageCount.setValue(pageCount.getValue() + 1);
   }
%>
```

JML include Tag

This tag includes the output of another JSP page, a servlet, or an HTML page in the response of the including page (the page invoking `include`). It provides the same functionality as the standard `jsp:include` tag except that the `page` attribute can also be expressed as a JML expression.

For general information about `include` usage, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* or the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Syntax

```
<jml:include page = "relativeURL" | "<%= jmlExpression %>"
             flush = "true" | "false" />
```

Attributes

For general information about `include` attributes and usage, refer to the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Example The following example includes the output of `table.jsp`, a presentation component that renders an HTML table based on data in the query string and request attributes.

```
<jml:include page="table.jsp?maxRows=10" flush="true" />
```

JML forward Tag

This tag forwards the request to another JSP page, a servlet, or an HTML page. It provides the same functionality as the standard `jsp:forward` tag except that the `page` attribute can also be expressed as a JML expression.

For general information about `forward` usage, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* or the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Syntax

```
<jml:forward page = "relativeURL" | "<%= jmlExpression %>" />
```

Attributes

For general information about `forward` attributes and usage, refer to the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

Example

```
<jml:forward page="altpage.jsp" />
```

JML print Tag

This tag provides essentially the same functionality as a standard JSP expression: `<%= expr %>`. A specified JML expression or string literal is evaluated, and the result is output into the response. With this tag, the JML expression does not have to be enclosed in `<%= ... %>` syntax; however, a string literal must be enclosed in double-quotes.

Syntax

```
<jml:print eval = '"stringLiteral"' | "jmlExpression" />
```

Attributes

- `eval` (required)—Specifies the string or expression to be evaluated and output.

Examples Either of the following examples outputs the current value of `salary`, which is of type `JmlNumber`:

```
<jml:print eval="$[salary]" />
```

or:

```
<jml:print eval="salary.getValue()" />
```

The following example prints a string literal:

```
<jml:print eval='"Your string here"' />
```

JML plugin Tag

This tag has functionality identical to that of the standard `jsp:plugin` tag.

For general information about `plugin` usage, refer to the *Oracle9iAS Containers for J2EE Support for JavaServer Pages Developer's Guide* or the Sun Microsystems *JavaServer Pages Specification, Version 1.2*.

B

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Index

E

F

G

H

I

J

L

M

N

O

P

R

S

T

U

W

X